HEATHKIT® MANUAL

for the

PLL ULTRASONIC DETECTOR

Model GDA-1158-2

I-595-1712-05

HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information ..... (616) 982-3411
Credit ..... (616) 982-3561
Replacement Parts ..... (616) 982-3571

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YOUR HEATHKIT 90-DAY FULL WARRANTY

If you are not satisfied with our service - warranty or otherwise - or with our products, write directly to our Director of Customer Services, Heath Company, Benton Harbor, Michigan 49022. He will make certain your problems receive immediate, personal attention.

Our attorney, who happens to be quite a kitbuilder himself, insists that we describe our warranty using all the necessary legal phrases in order to comply with the new warranty regulations. Fine. Here they are:

For a period of ninety (90) days after purchase, Heath Company will replace or repair free of charge any parts that are defective either in materials or workmanship. You can obtain parts directly from Heath Company by writing us at the address below or by telephoning us at (616) 982-3571. And we'll pay shipping charges to get those parts to you — anywhere in the world.

We warrant that during the first ninety (90) days after purchase, our products, when correctly assembled, calibrated, adjusted and used in accordance with our printed instructions, will meet published specifications.

If a defective part or error in design has caused your Heathkit product to malfunction during the warranty period through no fault of yours, we will service it free upon proof of purchase and delivery at your expense to the Heath factory, any Heathkit Electronic Center (units of Schlumberger Products Corporation), or any of our authorized overseas distributors.

You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

Our warranty does not cover and we are not responsible for damage caused by the use of corrosive solder, defective tools, incorrect assembly, misuse, fire, or by unauthorized modifications to or uses of our products for purposes other than as advertised. Our warranty does not include reimbursement for customer assembly or set-up time.

This warranty covers only Heathkit products and is not extended to allied equipment or components used in conjunction with our products. **We are not responsible for incidental or consequential damages.** Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

HEATH COMPANY
BENTON HARBOR, MI. 49022

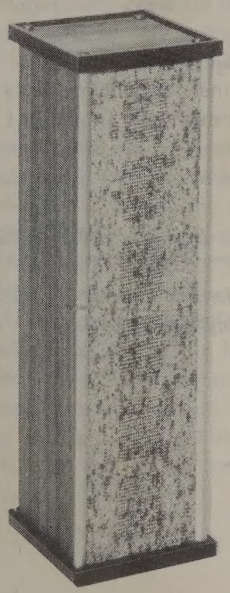
Prices and specifications subject to change without notice.

Assembly
and
Operation
of the

HEATHKIT®

PLL ULTRASONIC DETECTOR

MODEL GDA-1158-2



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HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

INTRODUCTION

The Heathkit PLL Ultrasonic Detector Model GDA-1158-2 unit was designed to work with your Power-Line-Linked Security System. It is a solid-state precision unit that responds to motion within its field of coverage; then it transmits a signal to the receiver in the Central Processor when it detects motion.

The Ultrasonic Detector operates on the doppler principle. The unit sends out a high frequency sound wave and then monitors that portion of the sound wave reflected from surrounding objects. If any object within its field of coverage moves, the movement is detected. An alarm signal is then transmitted to a remote receiver. Persons within the area of the Detector unit will remain unaware of the ultrasonic sound wave as its frequency is far above that detectable by the human ear. Pets are not affected by the ultrasonic sound waves.

Two simple controls on the back panel of the Ultrasonic Detector permit you to adjust the sensitivity (or maximum detection distance) and the persistence of the detectable motion, from 1/2 second to 2 seconds. Primarily, the persistence control eliminates the activation of the unit by short term vibration, shock, or flying insects.

The Ultrasonic Detector will not become operational for approximately 20 seconds after you apply power to it. This permits you to leave the area without sounding an alarm.

The Ultrasonic Detector is housed in an attractive walnut-grained cabinet that unobtrusively fits any decor, as well as to match other units in the PLL Security System. Like the other units of the Security System, the Ultrasonic Detector is powered by any 110-130 VAC, 60 Hz source.

Refer to the "Kit Builders Guide" (furnished with the Central Processor, GDA-1158-1) for information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly instructions.

UNPACKING

Your PLL Ultrasonic Detector packaging consists of the shipping carton which contains the cabinet assembly. Refer to Figure 1-1 and turn the cabinet assembly top-side-up as shown. Remove the four #6 x 5/8" phillips head screws that secure the end cover and end panel to the cabinet. Set the end cover, end panel, and four screws aside temporarily.

Carefully slide the rear panel upward and away from the cabinet. In the same manner, carefully slide the two circuit boards upward and out of the cabinet. Note that the remaining parts consist of three packages and several loose parts.

CAUTION: Do not squeeze the cabinet sides together or force them apart; this will damage the assembly. Also, DO NOT remove the bottom from the assembly.

You will be directed to open each package as it is needed. Each of the assembly sections of the Manual contains its own Parts List and step-by-step assembly instructions. At the beginning of each Parts List you will be instructed which numbered package to open. You will also be instructed to remove some parts from the "Misc." package to complete each assembly section.

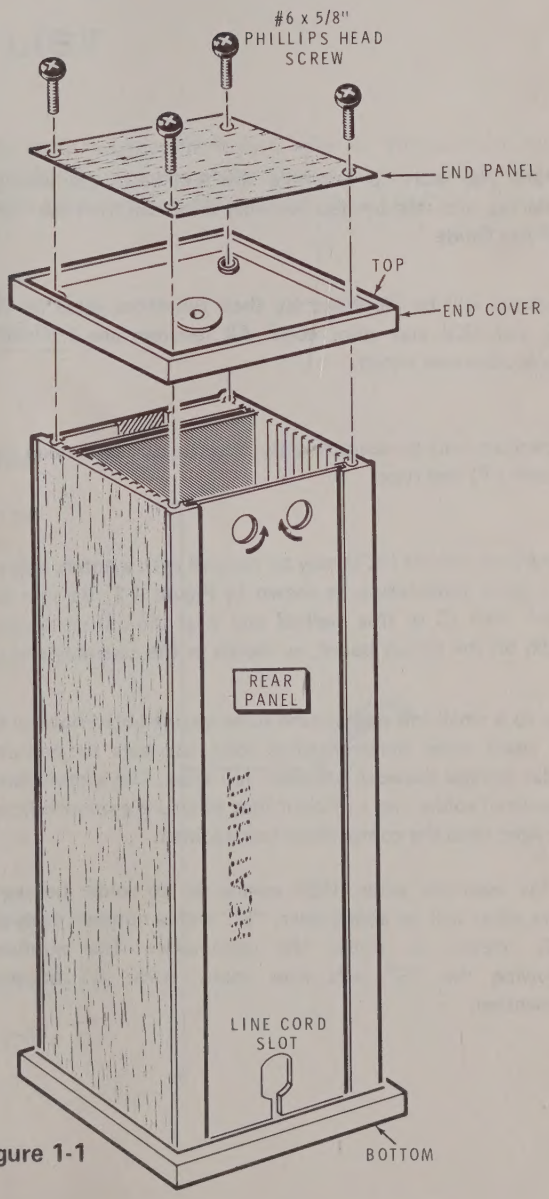


Figure 1-1

ASSEMBLY NOTES

Before you start to assemble this kit, read the wiring, soldering, and step-by-step assembly information in the "Kit Builders Guide."

Resistors will be identified by their resistance value (in Ω, kΩ, and MΩ) and color code. All resistors are 1/4-watt, unless otherwise noted.

Capacitors will be identified by their capacitance value (in pF and μF) and type.

Integrated circuits (IC's) may be marked with a notch, a dot, or a small indentation as shown in Figure 1-2. Be sure to install each IC so this marked end is at the outline of the notch on the circuit board, as shown in the assembly steps.

Due to a small foil area around some circuit board holes and the small areas between some foils, use care to prevent solder bridges between adjacent foil areas. Use a minimum amount of solder and sufficient heat to assure a smooth flow of solder onto the components being joined.

In the assembly steps, (NS) means not to solder because other wires will be added later. "S-" with a number, such as (S-3), means to solder the connection. The number following the "S" tells how many wires are at the connection.

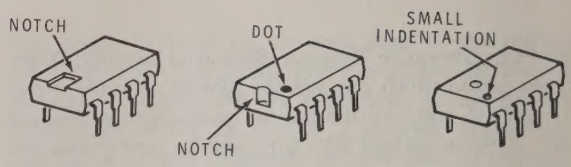
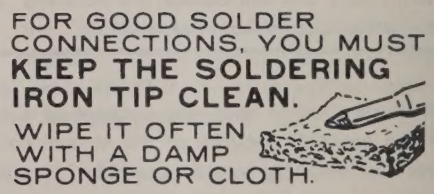


Figure 1-2

SAFETY WARNING: Avoid eye injury when you clip off excess lead lengths. We suggest you wear glasses, or at least clip the leads so the ends will not fly toward your eyes.



ULTRASONIC CIRCUIT BOARD

PARTS LIST

Remove the parts from Pack #1364 and check each part against the following list. Make a check (✓) in the space provided as you identify each part. Do not throw away any packing materials until all parts are accounted for.

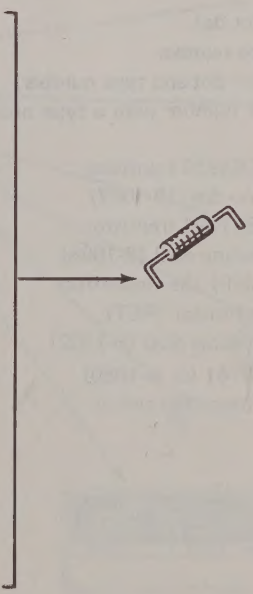
To order a replacement part, refer to "Replacement Parts" inside the rear cover of the Manual. For pricing information, refer to the separate "Heath Parts Price List."

QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.

RESISTORS, 1/4-WATT*

NOTE: 5% resistors have a gold fourth band; 10% resistors have a silver fourth band.

( )	2	10 Ω (brown-black-black)	1-55-12	R119, R129
( )	3	220 Ω (red-red-brown)	1-62-12	R103, R110, R111
( )	5	2200 Ω (red-red-red)	1-72-12	R106, R107, R108, R115, R117
( )	6	10 kΩ (brown-black-orange)	1-80-12	R105, R112, R113, R127, R128, R130
( )	6	18 kΩ (brown-gray-orange)	1-94-12	R121, R122, R123, R124, R125, R132
( )	5	100 kΩ (brown-black-yellow)	1-84-12	R102, R104, R109, R118, R131
( )	3	1 MΩ (brown-black-green)	1-87-12	R101, R114, R126
( )	3	2.2 MΩ (red-red-green)	1-37	R116, R120, R133



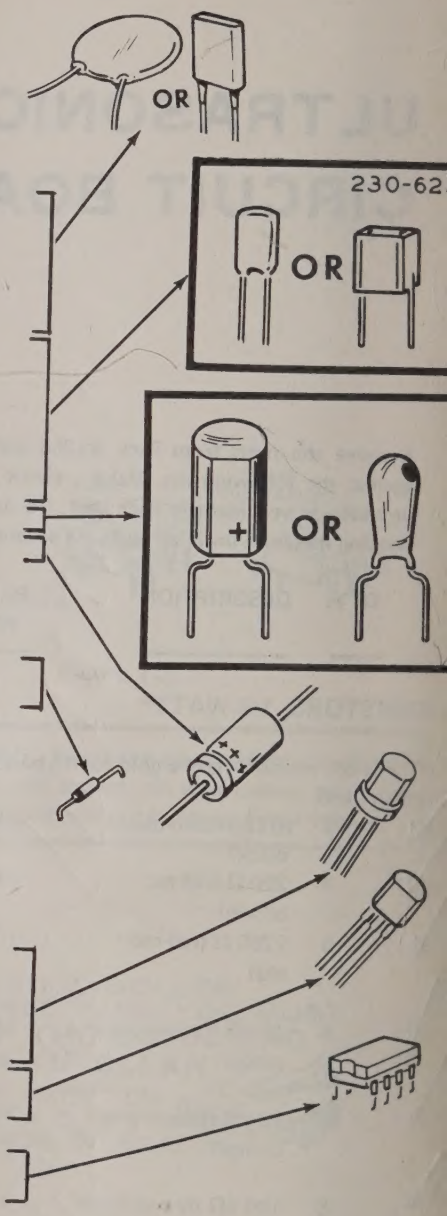
*Resistors ordered as replacement parts may be physically larger than those supplied with this kit.

QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
	CAPACITORS		
3	330 pF disc	230-1510	C104, C105, C113
2	.0033 µF disc	21-26	C114, C119
4	.1 µF disc or black oval	21-195	C108, C109, C110, C122
3	.01 µF (10n) block or black oval	230-624	C102, C106, C121
5	.1 µF block	230-623	C111, C115, C116, C117, C118
1	.47 µF block	230-1507	C112
1	10 µF electrolytic	25-257	C107
2	47 µF electrolytic	25-98	C101, C120
	DIODES-TRANSISTORS-INTEGRATED CIRCUITS (IC's)		
3	1N4454 diode	56-56	D101, D102, D104

NOTE: Transistors and IC's may be marked for identification in one of the following four ways.

1. Color dot.
2. Type number.
3. Color dot and type number.
4. Part number with a type number other than the one listed.

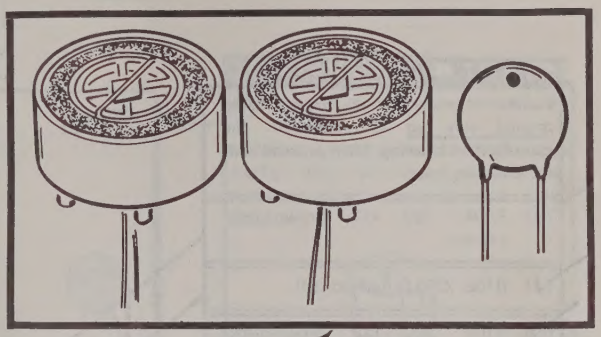
3	GE4936 transistor (no dot) (B-1097)	417-118	Q101, Q104, Q105
2	GE1691 transistor (white dot) (B-1098)	417-201	Q103, Q106
1	MSPF755 field-effect transistor (FET), (yellow dot) (B-1102)	230-1552	Q102
2	#741 (or A-1060) integrated circuit	442-22	A101, A102

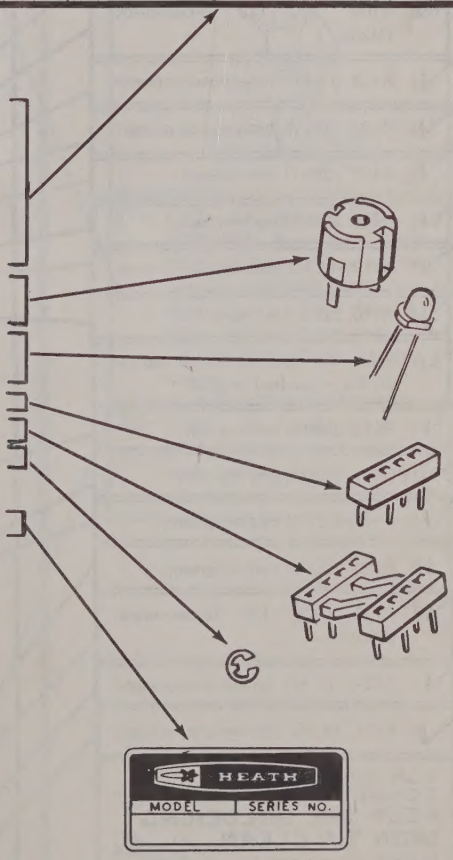


QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.

MISCELLANEOUS

NOTE: Some of the parts in this category may be in the shipping carton, or they may be in the smaller pack labeled "Misc."





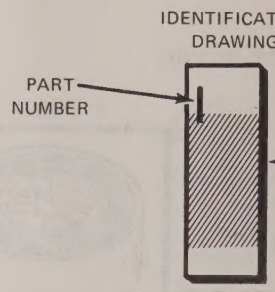
( )	1	Ultrasonic Circuit board (C-1364)	230-1551	
( )	1	Transducer assembly consisting of the following:	230-1553	
	1	Transmitter*		
	1	Receiver*		
	1	Capacitor* (marked with red dot)		
( )	1	RF choke (red dot)	230-1555	L102
( )	1	RF choke (white dot)	230-1556	L101
( )	1	Light emitting diode (LED)	230-1527	D103
( )	1	4-pin connector	230-1568	
( )	2	IC sockets	434-266	
( )	6	E-ring	253-107	
( )	8"	Bare wire (#20)	340-2	
( )	1	Blue and white label	391-34	

NOTE: Be sure you refer to the numbers on the blue and white label in any communications you may have about this kit with Heath Company. You may want to write the model and series numbers in this sample for a future convenience.

( )	1	Assembly Manual (See front cover for part number.)	
( )		Solder	

*Parts taped together.

STEP-BY-STEP ASSEMBLY



START

Position the ultrasonic circuit board printed side up as shown in the identification drawing. Then proceed with the following steps.

- ( ) R104. 100 kΩ (brown-black-yellow).
- ( ) R106. 2200 Ω (red-red-red).
- ( ) R109. 100 kΩ (brown-black-yellow).
- ( ) R113. 10 kΩ (brown-black-orange).
- ( ) R105. 10 kΩ (brown-black-orange).
- ( ) R107. 2200 Ω (red-red-red).
- ( ) R108. 2200 Ω (red-red-red).
- ( ) R112. 10 kΩ (brown-black-orange).
- ( ) R110. 220 Ω (red-red-brown).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.
- ( ) R115. 2200 Ω (red-red-red).
- ( ) R117. 2200 Ω (red-red-red).
- ( ) R116. 2.2 MΩ (red-red-green).
- ( ) R120. 2.2 MΩ (red-red-green).
- ( ) R118. 100 kΩ (brown-black-yellow).
- ( ) R122. 18 kΩ (brown-gray-orange).
- ( ) R121. 18 kΩ ((brown-gray-orange).

FOR GOOD SOLDER CONNECTIONS, YOU MUST **KEEP THE SOLDERING IRON TIP CLEAN.** WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.

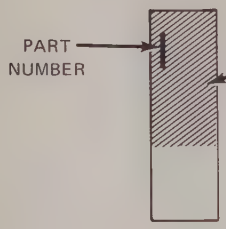
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

CONTINUE

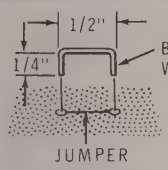
- ( ) R101. 1 MΩ (brown-black-green).
- ( ) R103. 220 Ω (red-red-brown).
- ( ) R102. 100 kΩ (brown-black-yellow).
- ( ) R111. 220 Ω (red-red-brown).
- ( ) R131. 100 kΩ (brown-black-yellow).
- ( ) R130. 10 kΩ (brown-black-orange).
- ( ) R132. 18 kΩ (brown-gray-orange).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.
- ( ) R126. 1 MΩ (brown-black-green).
- ( ) R125. 18 kΩ (brown-gray-orange).
- ( ) R128. 10 kΩ (brown-black-orange).
- ( ) R127. 10 kΩ (brown-black-orange).
- ( ) R114. 1 MΩ (brown-black-green).
- ( ) R129. 10 Ω (brown-black-black).
- ( ) R119. 10 Ω (brown-black-black).
- ( ) R123. 18 kΩ (brown-gray-orange).
- ( ) R124. 18 kΩ (brown-gray-orange).
- ( ) R133. 2.2 MΩ (red-red-green).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 1-1

IDENTIFICATION DRAWING

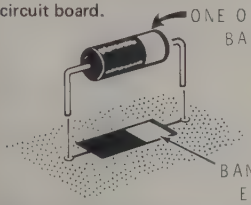


START



(V) Cut a 1" length of bare wire. Bend the wire as shown; then install the wire at JUMPER.

NOTE: When you install diodes, as in the following steps, be sure you position the banded end of the diode as shown on the circuit board.

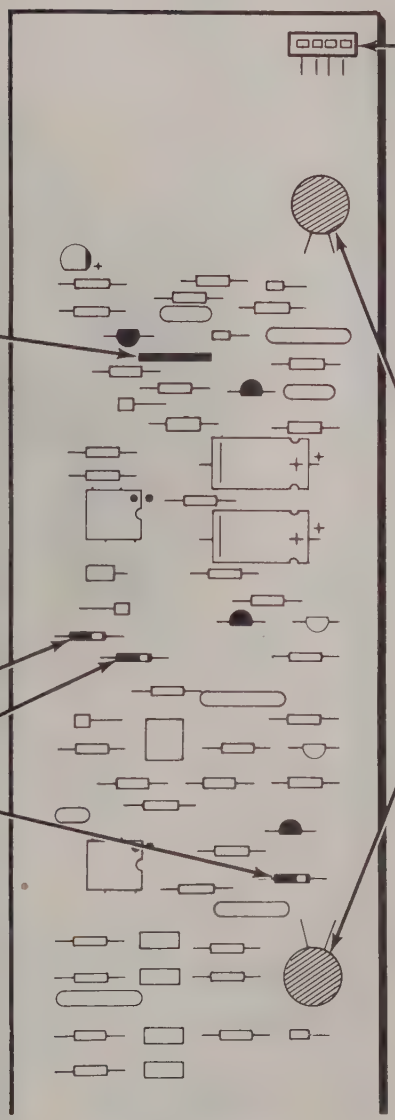


(V) D101: 1N4454 diode (#56-56).

(V) D102. 1N4454 diode (#56-56).

(V) D104. 1N4454 diode (#56-56).

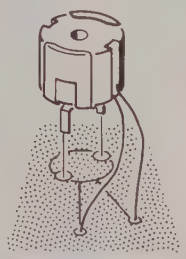
(V) Solder the leads to the foil and cut off the excess lead lengths.



CONTINUE

(V) 4-pin connector. Solder the leads to the foil.

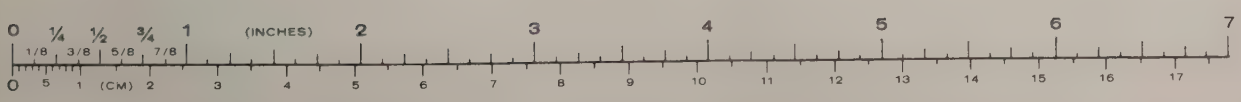
NOTE: When you install coils in the following steps, handle the small wires with care.



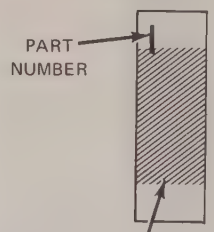
(V) L101. RF choke (white dot, #230-1556). Mount the choke; then solder the mounting tabs to the foil. Install the two leads in their holes as shown. Leave a little slack in the leads; then solder the leads to the foil and cut off the excess lead lengths.

(V) L102. RF choke (red dot, #230-1555). Mount this coil in the same manner as the coil in the previous step.

PICTORIAL 1-2



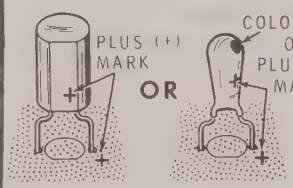
IDENTIFICATION DRAWING



The steps performed in this Pictorial are in this area of the circuit board.

START

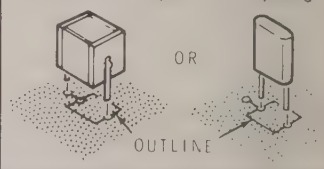
NOTE: When you install electrolytic capacitors, be sure to match the plus (+) mark or color dot on the capacitor with the plus (+) mark on the circuit board as shown.



- ( ) C107. 10 µF electrolytic.
- ( ) C105. 330 pF disc.
- ( ) C108. .1 µF disc or black oval.
- ( ) C111. .1 µF block.
- ( ) C109. .1 µF disc or black oval.
- ( ) C119. .0033 µF disc.
- ( ) C110. .1 µF disc or black oval.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.
- ( ) C112. .47 µF block.
- ( ) C113. 330 pF disc.
- ( ) C115. .1 µF block.
- ( ) C114. .0033 µF disc.
- ( ) C117. .1 µF block.
- ( ) Solder the leads to the foil and cut off the excess lead length.

CONTINUE

NOTE: Some of the following block capacitors can be one of two types. Always mount the capacitor over the outline on the circuit board and use the holes that fit the capacitor lead spacing.



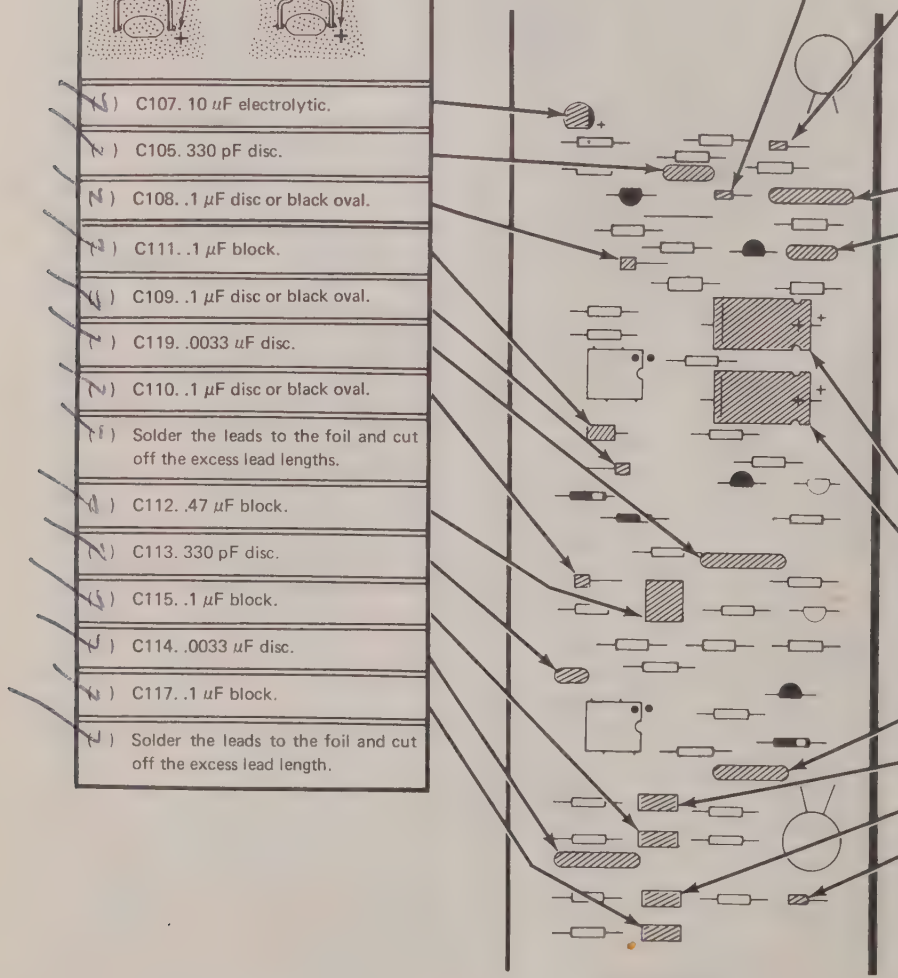
- ( ) C106. .01 µF (10n) block or black oval.
- ( ) C102. .01 µF (10n) block or black oval.

NOTE: In the following step, the capacitor has not been given a specific value. It is the disc capacitor with a red dot on it, and is taped to the transducers. It has been selected to match the receiver and transmitter transducer assemblies.

- ( ) C103. Red dot disc capacitor.
- ( ) C104. 330 pF disc.

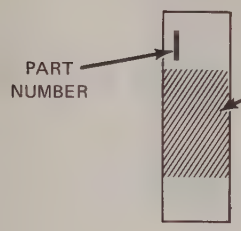
NOTE: When you install electrolytic capacitors, match the positive (+) mark on the capacitor to the positive (+) mark on the circuit board.

- ( ) C101. 47 µF electrolytic.
- ( ) C120. 47 µF electrolytic.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.
- ( ) C122. .1 µF disc or black oval.
- ( ) C118. .1 µF block.
- ( ) C116. .1 µF block.
- ( ) C121. .01 µF (10n) block or black oval.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.



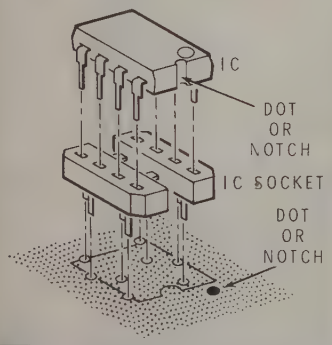
PICTORIAL 1-3

IDENTIFICATION DRAWING



START

Mount IC sockets in the following steps. Solder the leads to the foil. Then carefully push the IC into the socket. Be sure to match the marked end of the IC with the notch outline on the circuit board. Refer to Figure 1-2 on Page 4.

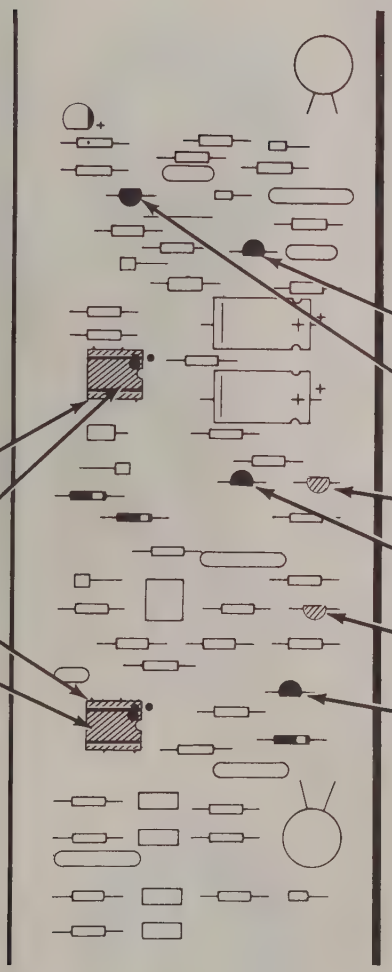


( ) IC socket at A101.

( ) A101. #741 (or A-1060) integrated circuit.

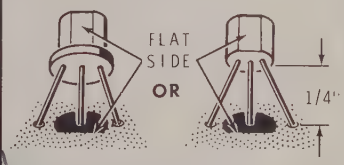
( ) IC socket at A102.

( ) A102. #741 (or A-1060) integrated circuit.



CONTINUE

NOTE: When you install transistors in the following steps, be sure to match the flat of the transistor with the flat outline on the circuit board. As you install each transistor, solder its leads to the foil. Then cut off the excess lead lengths.



( ) Q101. GE4936 (B-1097) (no dot) transistor (#417-118).

( ) Q102. MSPF755 (B-1102) (yellow dot) field effect transistor (#230-1552).

( ) Q106. GE1691 (B-1098) (white dot) transistor (#417-201).

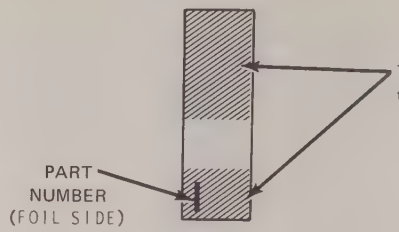
( ) Q105. GE4936 (B-1097) (no dot) transistor (#417-118).

( ) Q103. GE1691 (B-1098) (white dot) transistor (#417-201).

( ) Q104. GE4936 (B-1097) (no dot) transistor (#417-118).

PICTORIAL 1-4

IDENTIFICATION DRAWING

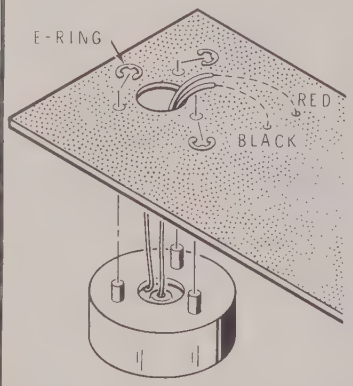


START

Turn the ultrasonic circuit board foil-side-up and position it as shown in the identification drawing.

NOTES:

1. When you install the transducers in the following steps, push the mounting pins through the circuit board from the foil side. Secure each mounting pin with an E-ring on the component side of the board as shown below. Then, route the red and black leads to their appropriate holes and solder them to the foil. Cut off the excess lead lengths.

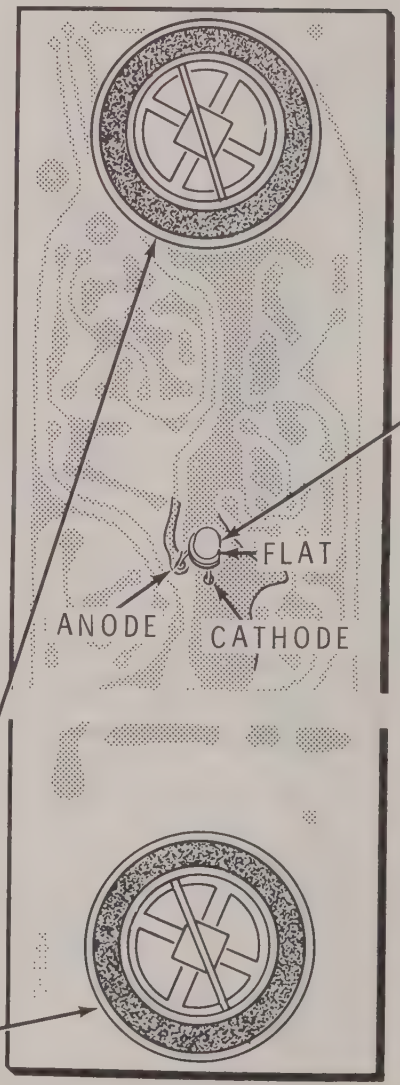


2. In the next two steps, the E-rings will form grooves in the transducer mounting studs.

3. In the following steps, you will need to identify the receiver and transmitter transducers. The receiver transducer has white silicone sealing compound around the lead wires where they emerge from the transducer, and a gray coating on the small square ceramic element. The transmitter transducer has no sealing compound and an uncoated element.

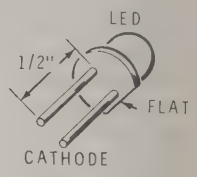
( ) Install the transducer marked "RECEIVER." Secure its mounting pins with E-rings. Install the red and black leads in their holes and solder them to the foil.

( ) Install the transducer marked "TRANSMITTER." Secure its mounting pins with E-rings. Install the red and black leads in their holes and solder them to the foil.



CONTINUE

Carefully study the case of the LED (light emitting diode). Note that the case has a flat on one side. This flat is adjacent to the Cathode lead. The other lead is the anode lead.



( ) Cut both leads of the LED to 1/2".

( ) Place the cathode lead (closest to the flat on the case) into the indicated hole in the circuit board foil (S-1), and place the anode lead into its hole as shown (S-1). Make sure neither LED lead touches other circuit board foils. Position the LED straight up from the board as shown (approximately 5/8" overall).

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

( ) Unsoldered connections.

( ) "Cold" (crystallized) solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

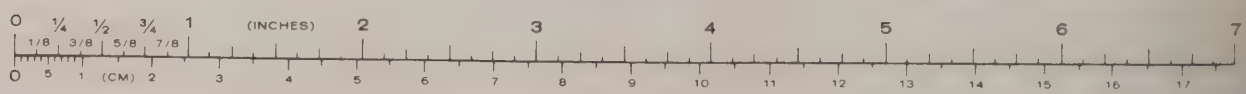
( ) Transistors and integrated circuits for the proper type and installation.

( ) Electrolytic capacitors for the correct position of the positive (+) end.

( ) Diodes for the correct position of the banded end (all to the same side of the circuit board). NOTE: Some circuit board holes will remain open.

Set the circuit board aside temporarily.

PICTORIAL 1-5



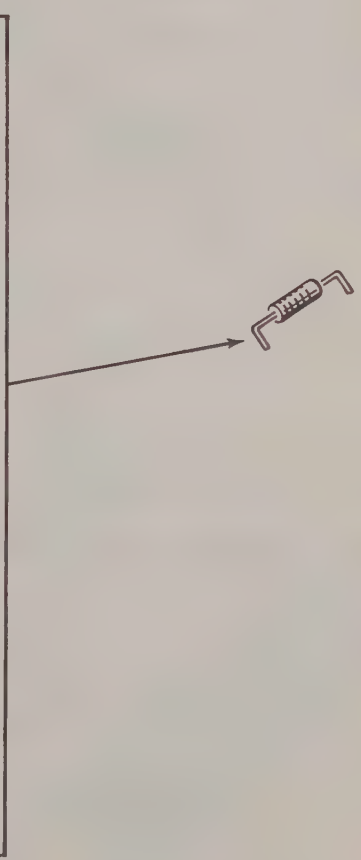
PLL CIRCUIT BOARD

PARTS LIST

Remove the parts from Pack #1365 and check each part against the following list. Make a check (✓) in the space provided as you identify each part. Do not throw away any packing materials until all parts are accounted for.

To order a replacement part, refer to "Replacement Parts" inside the rear cover of the Manual. For pricing information, refer to the separate "Heath Parts Price List."

	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
RESISTORS, 1/4-WATT*				
NOTE: 5% resistors have a gold fourth band.				
( )	3	10 Ω (brown-black-black)	1-55-12	R229, R233, R234
( )	1	100 Ω (brown-black-brown)	1-60-12	R204
( )	2	470 Ω (yellow-violet-brown)	1-65-12	R205, R223
( )	4	1000 Ω (brown-black-red)	1-69-12	R222, R225, R226, R232
( )	2	2200 Ω (red-red-red)	1-72-12	R224, R228
( )	1	4700 Ω (yellow-violet-red)	1-76-12	R235
( )	12	10 kΩ (brown-black-orange)	1-80-12	R208, R211, R214, R219, R227, R230, R231, R238, R239,R240, R242,R243
( )	1	18 kΩ (brown-gray-orange)	1-94-12	R207
( )	1	22 kΩ (red-red-orange)	1-91-12	R236
( )	3	47 kΩ (yellow-violet-orange)	1-83-12	R218, R220, R237
( )	1	100 kΩ (brown-black-yellow)	1-84-12	R212
( )	5	1 MΩ (brown-black-green)	1-87-12	R201, R202, R216, R217, R221
( )	2	2.2 MΩ (red-red-green)	1-37	R209, R210
( )	1	4.7 MΩ (yellow-violet-green)	1-109-12	R213



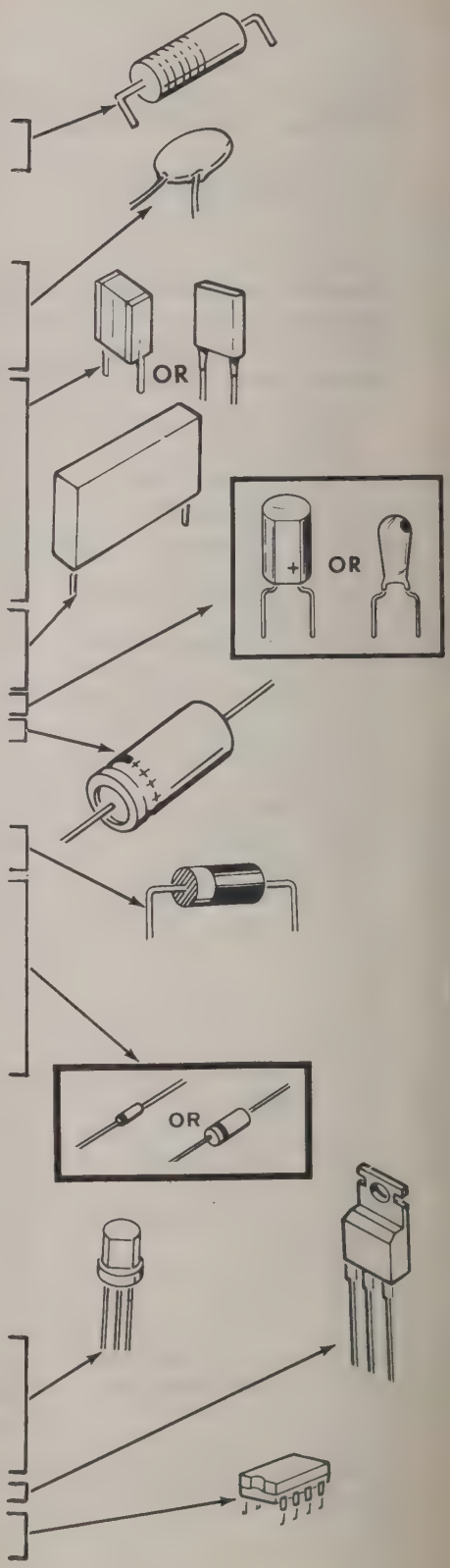
*Resistors ordered as replacement parts may be physically larger than those supplied with this kit.

	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
Other Resistor				
( )	1	150 Ω, 2-watt (brown-green-brown)	1-42-2	R203
CAPACITORS				
( )	3	330 pF disc	230-1510	C210, C221, C223
( )	1	.0033 μF disc	21-26	C213
( )	1	.0047 μF disc	21-72	C201
( )	1	.01 μF (10n) block or black oval	230-624	C220
( )	7	.1 μF block or black oval	230-623	C205, C209, C212, C216, C217, C218, C219
( )	3	.47 μF block	230-1507	C208, C211, C222
( )	5	.47 μF molded	230-622	C202, C203, C204, C224, C225
( )	2	10 μF electrolytic	25-257	C214, C215
( )	2	1000 μF electrolytic	230-1560	C206, C207
DIODES-TRANSISTORS-INTEGRATED CIRCUITS (IC's)				
( )	6	1N4002 or SCE1 diode	57-65	D201, D202, D203, D204, D213, D214
( )	7	1N4454 or 1N4149 diode	56-56	D206, D207, D208, D209, D210, D211, D215
( )	1	1N4742A, 1N5738B (or #ZB12A) zener diode	56-90	D205

NOTE: Transistors and IC's may be marked for identification in one of the following four ways.

1. Color dot.
2. Type number.
3. Color dot and type number.
4. Part number with a type number other than the one listed.

( )	6	GE4936 transistor (no dot) (B-1097)	417-118	Q203, Q204, Q206, Q208, Q209, Q211
( )	4	GE1691 transistor (white dot) (B-1098)	417-201	Q202, Q205, Q207, Q210
( )	1	64566 transistor (2N6106)	230-1503	Q201
( )	2	#741 (or A1060) integrated circuit	442-22	A201, A202

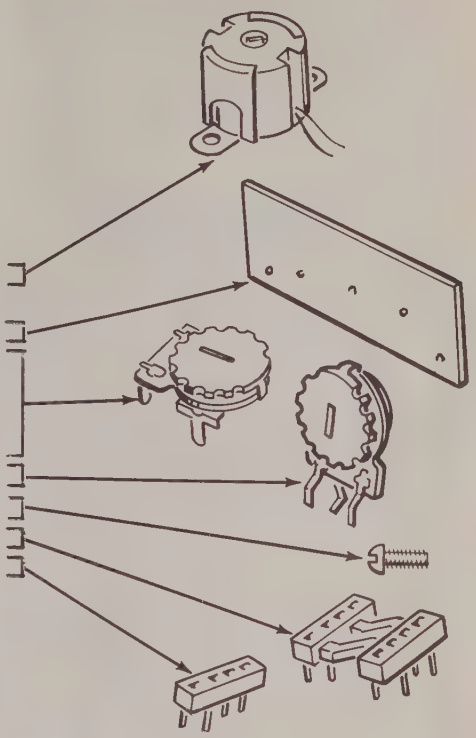


QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.

MISCELLANEOUS

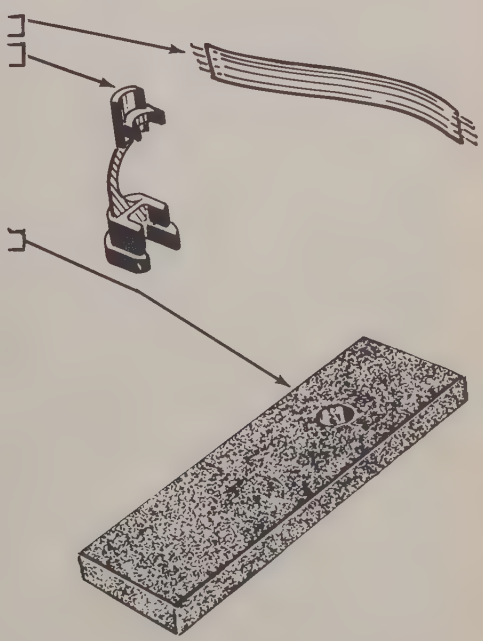
NOTE: Some of the parts in this category may be in the shipping carton.

( )	1	PLL circuit board (C-1365)	230-1557	
( )	1	RF coil (gold dot)	230-1559	L203
( )	2-1/2"	Stranded wire (fuse)	344-90	F1
( )	1	Small circuit board	230-1558	L201, L202
( )	1	5000 Ω (5K) control (black)	10-394	R206
( )	1	250 kΩ control (white)	10-960	R215
( )	1	250 kΩ control (blue)	10-317	R241
( )	2	4-40 x 1/4" screw	250-52	
( )	2	IC socket	434-266	
( )	1	4-pin connector	230-1568	
( )	1	Line cord	89-13	



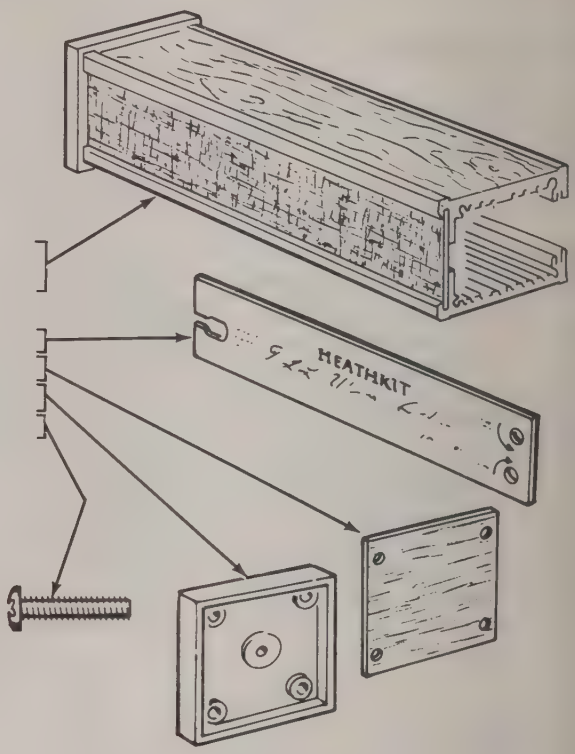
CABINET PARTS

( )	1	4-conductor cable	230-1567
( )	1	Strain relief	75-71
( )	1	Foam cushion	230-1566



QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.

CABINET PARTS (Cont'd.)

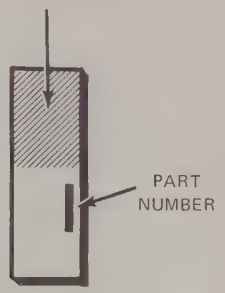


Cabinet assembly consisting of:

( )	1	Cabinet with end panel attached	230-1562
( )	1	Rear panel	230-1563
( )	1	End panel	230-1564
( )	1	End cover	230-1565
( )	4	6-32 x 5/8" screw	230-1520

STEP-BY-STEP ASSEMBLY

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION DRAWING

START

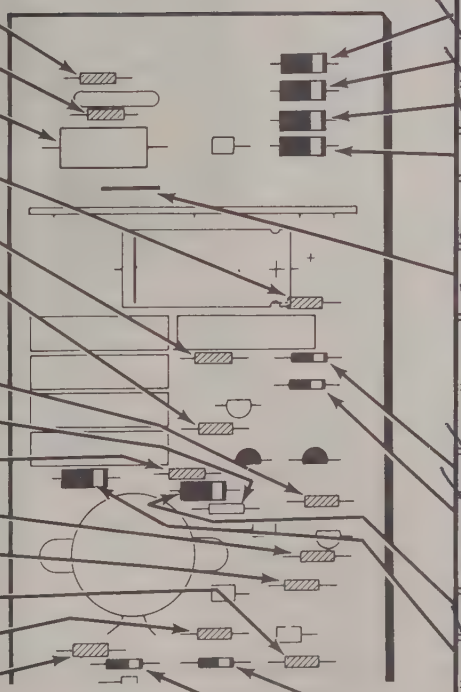
Position the PLL circuit board printed side up as shown in the identification drawing. Then proceed with the following steps.

- ( ) R201. 1 MΩ (brown-black-green).
- ( ) R202. 1 MΩ (brown-black-green).
- ( ) R203. 150 Ω, 2-watt, 10% (brown-green-brown).
- ( ) R232. 1000 Ω (brown-black-red).
- ( ) R229. 10 Ω (brown-black-black).
- ( ) R234. 10 Ω (brown-black-black).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.
- ( ) R230. 10 kΩ (brown-black-orange).
- ( ) R231. 10 kΩ (brown-black-orange).
- ( ) R233. 10 Ω (brown-black-black).
- ( ) R225. 1000 Ω (brown-black-red).
- ( ) R227. 10 kΩ (brown-black-orange).
- ( ) R226. 1000 Ω (brown-black-red).
- ( ) R228. 2200 Ω (red-red-red).
- ( ) R243. 10 kΩ (brown-black-orange).

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.

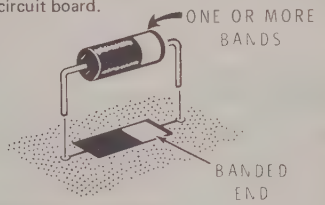
- ( ) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 2-1

CONTINUE

NOTE: When you install diodes, as in the following steps, be sure you position the banded end of each diode as shown on the circuit board.



Install 1N4002 or SCE1 diodes (#57-65) at:

- ( ) D203.
- ( ) D204.
- ( ) D201.
- ( ) D202.
- ( ) Remove one strand of wire from the short length of stranded wire.
- ( ) F1. Install the single strand of small wire.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

Install 1N4454 or 1N4149 diodes (#56-56) at:

- ( ) D211.
- ( ) D210.

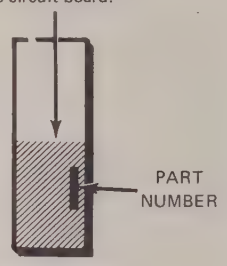
Install 1N4002 or SCE1 diodes (#57-65) at:

- ( ) D213.
- ( ) D214.

Install 1N4454 or 1N4149 diodes at:

- ( ) D209.
- ( ) D208.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

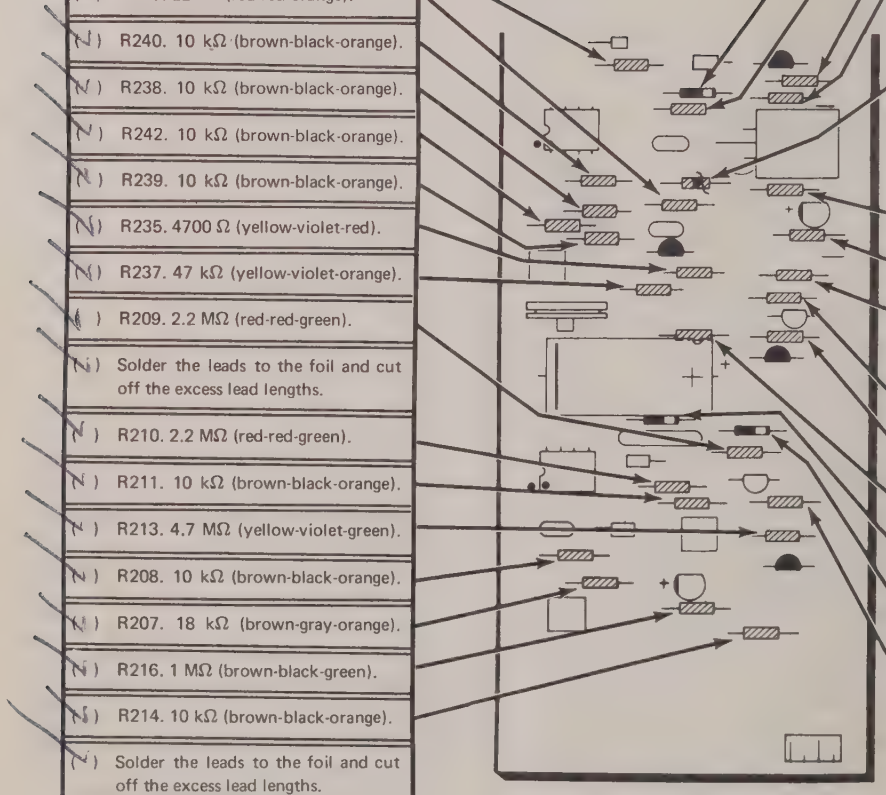
The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION DRAWING

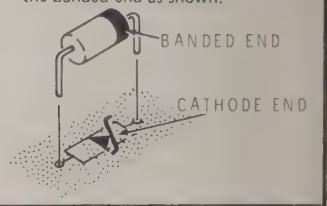
START

- ( ) R223. 470 Ω (yellow-violet-brown).
- ( ) R236. 22 kΩ (red-red-orange).
- ( ) R240. 10 kΩ (brown-black-orange).
- ( ) R238. 10 kΩ (brown-black-orange).
- ( ) R242. 10 kΩ (brown-black-orange).
- ( ) R239. 10 kΩ (brown-black-orange).
- ( ) R235. 4700 Ω (yellow-violet-red).
- ( ) R237. 47 kΩ (yellow-violet-orange).
- ( ) R209. 2.2 MΩ (red-red-green).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.
- ( ) R210. 2.2 MΩ (red-red-green).
- ( ) R211. 10 kΩ (brown-black-orange).
- ( ) R213. 4.7 MΩ (yellow-violet-green).
- ( ) R208. 10 kΩ (brown-black-orange).
- ( ) R207. 18 kΩ (brown-gray-orange).
- ( ) R216. 1 MΩ (brown-black-green).
- ( ) R214. 10 kΩ (brown-black-orange).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.



CONTINUE

- ( ) D215. 1N4454 diode (#56-56). Position the banded end as shown.
- ( ) R221. 1 MΩ (brown-black-green).
- ( ) R224. 2200 Ω (red-red-red).
- ( ) R220. 47 kΩ (yellow-violet-orange).
- ( ) D205. 1N4742A, 1N5738B (or ZB12A) diode (#56-90). Position the banded end as shown.



- ( ) R205. 470 Ω (yellow-violet-brown).
- ( ) R204. 100 Ω (brown-black-brown).
- ( ) R222. 1000 Ω (brown-black-red).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.
- ( ) R217. 1 MΩ (brown-black-green).
- ( ) R218. 47 kΩ (yellow-violet-orange).
- ( ) R219. 10 kΩ (brown-black-orange).
- ( ) D206. 1N4454 diode (#56-56). Position the banded end as shown.
- ( ) D207. 1N4454 diode (#56-56). Position the banded end as shown.
- ( ) R212. 100 kΩ (brown-black-yellow).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-2

START

When you install transistors in the following steps, be sure to match the flat of the transistor with the flat outline on the circuit board. As each transistor is installed, solder its leads to the foil and cut off the excess lead length.

( ) Q210. GE1691 (B-1098) (white dot) transistor (#417-201).

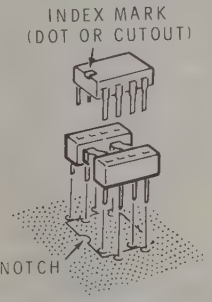
( ) Q209. GE4936 (B-1097) (no dot) transistor (#417-118).

( ) Q208. GE4936 (B-1097) (no dot) transistor (#417-118).

( ) Q207. GE1691 (B-1098) (white dot) transistor (#417-201).

( ) Q206. GE4936 (B-1097) (no dot) transistor (#417-118).

Mount IC sockets in the following steps. Solder the leads to the foil. Then carefully push the IC's into the sockets. Be sure to match the marked end of the IC with the notch outline on the circuit board. Refer to Figure 1-2 on Page 4 to correctly identify IC's.

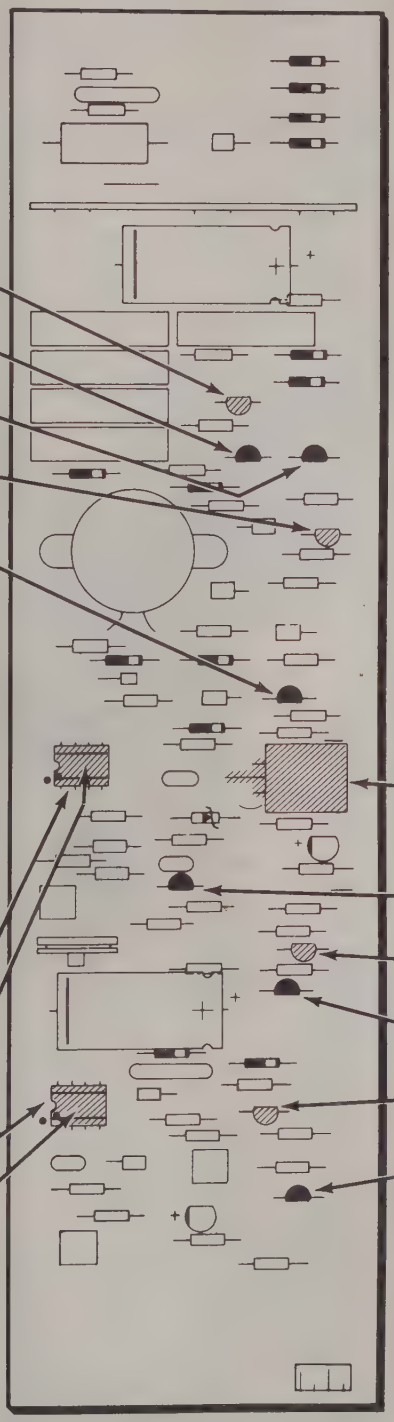


( ) IC socket at A202.

( ) A202. #741 (or A-1060) integrated circuit.

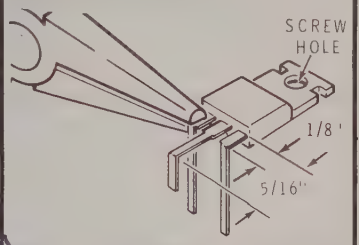
( ) IC socket at A201.

( ) A201. #741 (or A-1060) integrated circuit.



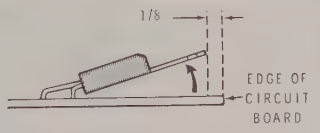
CONTINUE

( ) Form the leads of the 64566 transistor (#230-1503) as shown. Hold the leads with pliers to avoid damage to the transistor case. The screw hole is not used.



( ) Q201. Mount the 64566 transistor. Solder the leads to the foil and cut off the excess lead lengths.

NOTE: If the transistor tab extends over the edge of the circuit board, bend the transistor up so that the tab is at least 1/8" from the edge of the board.



( ) Q211. GE4396 (B-1097) (no dot) transistor (#417-118).

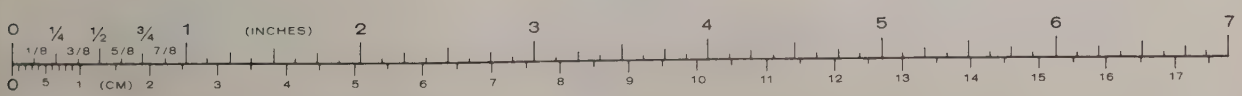
( ) Q205. GE1691 (B-1098) (white dot) transistor (#417-201).

( ) Q204. GE4396 (B-1097) (no dot) transistor (#417-118).

( ) Q202. GE1691 (B-1098) (white dot) transistor (#417-201).

( ) Q203. GE4396 (B-1097) (no dot) transistor (#417-118).

PICTORIAL 2-3

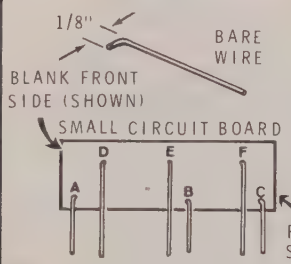


START

NOTE: If the wires have already been installed on your small circuit board, disregard the next four steps (only).

( ) Cut three 1/2" lengths and three 1" lengths of bare wire. NOTE: Do not use the fine fuse wire.

( ) At one end, bend a 1/8" length 90 degrees on all six wires as shown.



NOTE: As you mount each of the following bare wires on the front (blank) side of the small circuit board, crimp the short wire end down onto the foil. Position the wire as shown; then solder it to the foil.

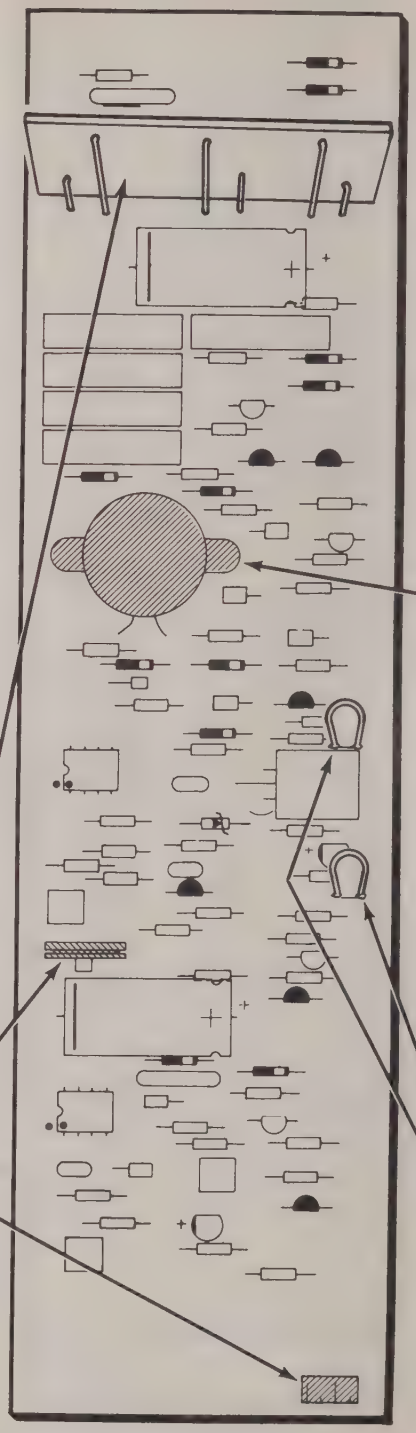
( ) Three 1/2" wires at A, B, and C.

( ) Three 1" wires at D, E, and F.

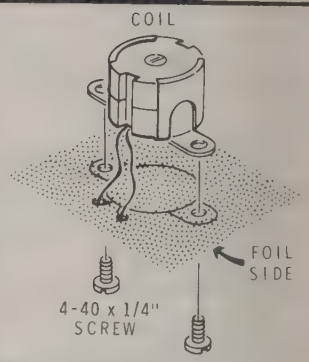
( ) Mount the small circuit board at L201 and L202 as shown. Solder all six wires to the PLL circuit board foil and cut off any excess wire lengths. Be sure none of the connections on the small board has loosened.

( ) R241. 250 kΩ (blue) control. Solder the control lugs to the foil.

( ) 4-pin connector. Solder the leads to the foil.



CONTINUE

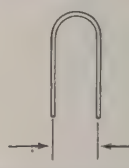


( ) Mount the RF coil (gold dot) at L203. Use 4-40 x 1/4" screws.

( ) Pass the RF choke leads through the holes in the circuit board as shown. Solder the leads to the circuit board and cut off any excess lead lengths.

( ) Cut two 1" lengths of bare wire.

( ) Form each 1" wire as shown.



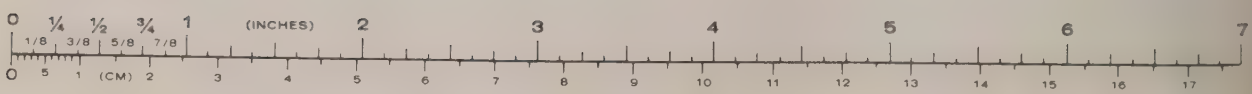
NOTE: When you install the shaped wires in the following steps, push them through the foil side of the board only far enough to make a good solder connection (approximately 3/8" above the board).

( ) TP7. Shaped 1" wire.

( ) TP22. Shaped 1" wire.

( ) Solder the wires to the foil and cut off the excess wire lengths.

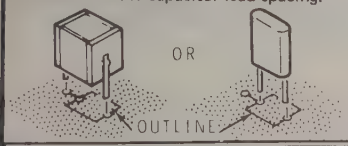
PICTORIAL 2-4



START

( ) C201. .0047 μF disc.

NOTE: Some of the following block capacitors can be one of two types. Always mount the capacitor over the outline on the circuit board and use the holes that fit the capacitor lead spacing.



( ) C205. .1 μF block or black oval.

( ) C224. .47 μF molded.

( ) C202. .47 μF molded.

( ) C203. .47 μF molded.

( ) C204. .47 μF molded.

( ) Solder the leads to the foil and cut off the excess lead lengths.

( ) C219. 1 μF block or black oval.

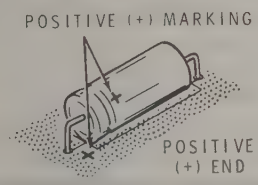
( ) C218. .1 μF block or black oval.

( ) C217. .1 μF block or black oval.

( ) C220. .01 μF (10n) block or black oval.

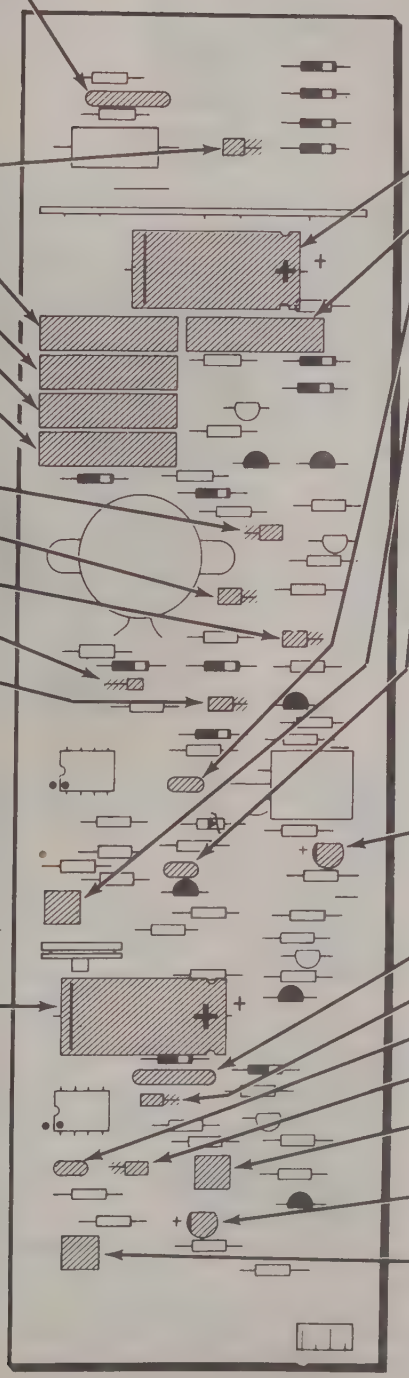
( ) C216. .1 μF block or black oval.

Position the positive (+) end of each of the following electrolytic capacitors as shown.



( ) C207. 1000 μF electrolytic.

( ) Solder the leads to the foil and cut off the excess lead lengths.



CONTINUE

( ) C206. 1000 μF electrolytic.

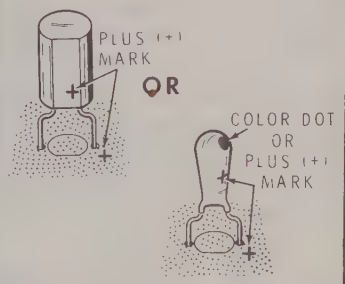
( ) C225. .47 μF molded.

( ) C223. 330 pF disc.

( ) C222. .47 μF block.

( ) C221. 330 pF disc.

NOTE: When you install an electrolytic capacitor, be sure to match the plus (+) mark or color dot on the capacitor with the plus (+) mark on the circuit board as shown.



( ) C215. 10 μF electrolytic.

( ) Solder the leads to the foil and cut off the excess lead lengths.

( ) C213. .0033 μF disc.

( ) C212. .1 μF block.

( ) C210. 330 pF disc.

( ) C209. .1 μF block.

( ) C211. .47 μF block.

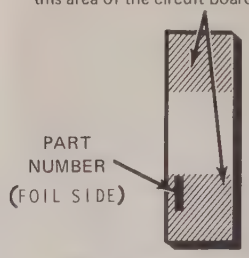
( ) C214. 10 μF electrolytic. Position the positive (+) mark and flat (or color dot) as shown.

( ) C208. .47 μF block.

( ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-5

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION DRAWING

START

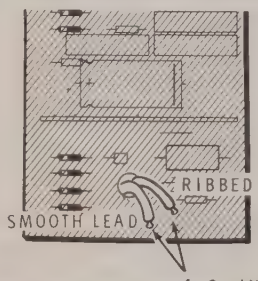
Turn the PLL circuit board foil-side-up and position it as shown in the identification drawing.

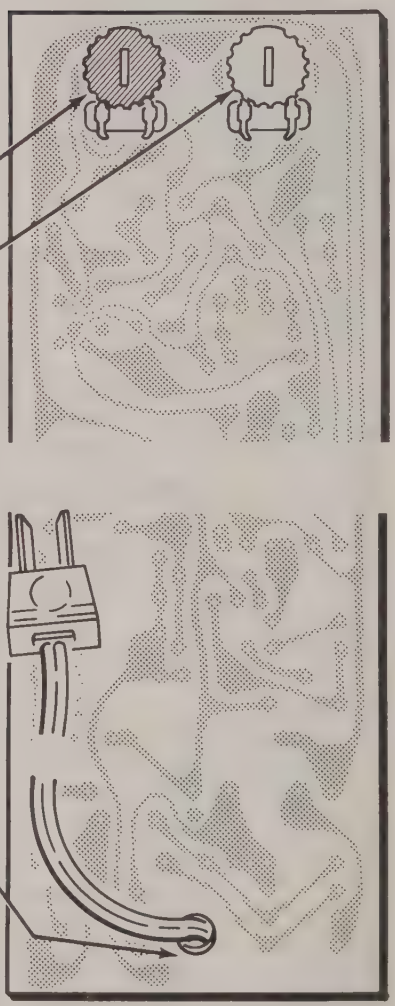
( ) R206. 5000 Ω (5K) (black) control. Solder all four lugs to the foil.

( ) R215. 250 kΩ (white) control. Solder all four lugs to the foil.

NOTE: It is important that the ribbed and smooth sides of the line cord be correctly identified and installed in the following steps. The drawing shows how to identify these leads.

( ) Push the free end of the line cord through the indicated hole in the circuit board. Push the ribbed and smooth line cord leads through their respective holes on the top of the board. Solder the leads to the foil and cut off the excess lead lengths.





PICTORIAL 2-6

CONTINUE

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

( ) Unsoldered connections.

( ) "Cold" (crystallized) solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

( ) Transistors and integrated circuits for the proper type and installation.

( ) Electrolytic capacitors for the correct position of the positive (+) end.

( ) Diodes for the correct position of the banded end.

FINISH

INITIAL TEST

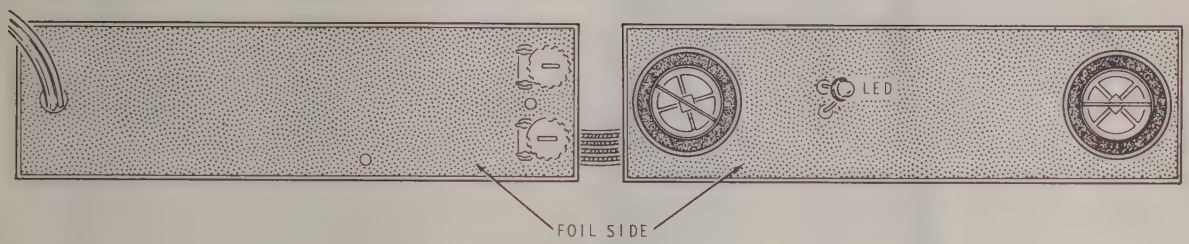


Figure 2-1

Refer to Figure 2-1 as you perform the following steps. DO NOT PLUG THE LINE CORD INTO AN AC OUTLET UNTIL YOU ARE TOLD TO DO SO.

( ) Push one end of the 4-conductor cable into the 4-pin connector on the PLL circuit board.

( ) Set the two controls to their mid-range positions as shown.

( ) Position the PLL and Ultrasonic boards end-to-end, close together so the 4-pin connectors are close together. Then push the free end of the 4-conductor cable into the connector on the Ultrasonic circuit board.

( ) At the same time, carefully turn both circuit boards foil-side-up. Be sure both ends of the 4-conductor cable are firmly connected.

CAUTION: AFTER YOU PLUG THE LINE CORD INTO AN AC OUTLET, DO NOT TOUCH EITHER CIRCUIT BOARD. POTENTIALLY DANGEROUS VOLTAGES ARE PRESENT.

NOTE: In the following steps, if you do not get the desired results, remove the line cord from the AC outlet and refer to the "In Case of Difficulty" section of this Manual on Page 29.

( ) Plug the line cord into an AC outlet.

( ) Slowly pass your hand back and forth above the ultrasonic circuit board at a distance of 2 to 3 feet. Carefully observe the LED on the ultrasonic board; it should glow faintly after approximately 20 seconds.

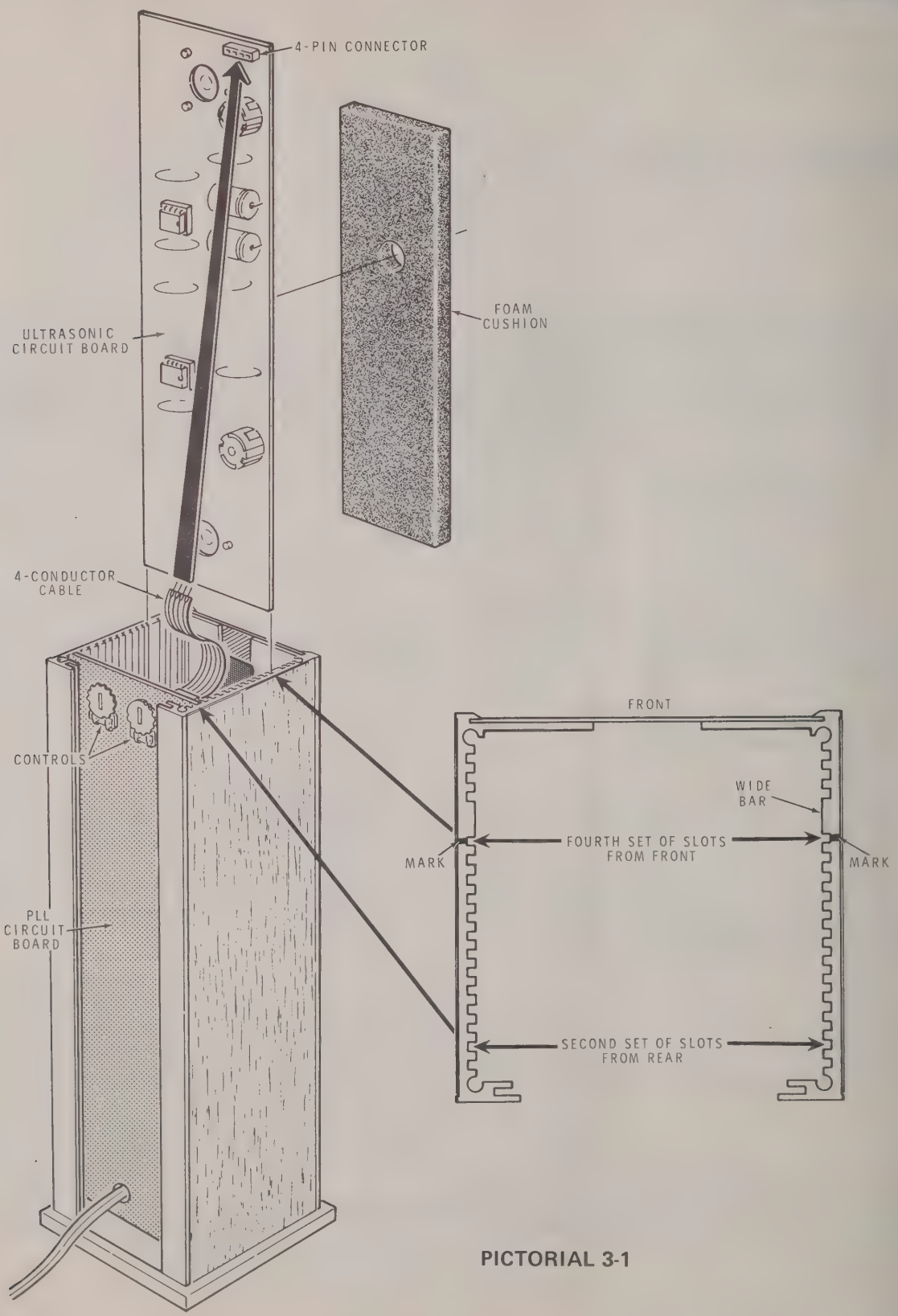
( ) Completely stop all motion in the area of the circuit boards. The glow of the LED should slowly diminish and finally go out.

( ) Repeat the last two steps as you vary the type of motion and distance away from the circuit boards. In each case, the LED should at first glow faintly, and then diminish and go out as the motion stops.

( ) Unplug the line cord from the AC outlet.

( ) Disconnect the 4-conductor cable from both circuit boards.

This completes the "Initial Test." To align your Ultrasonic Detector, refer directly to the "Alignment" section of the GDA-1158-1 Central Processor Manual.



PICTORIAL 3-1

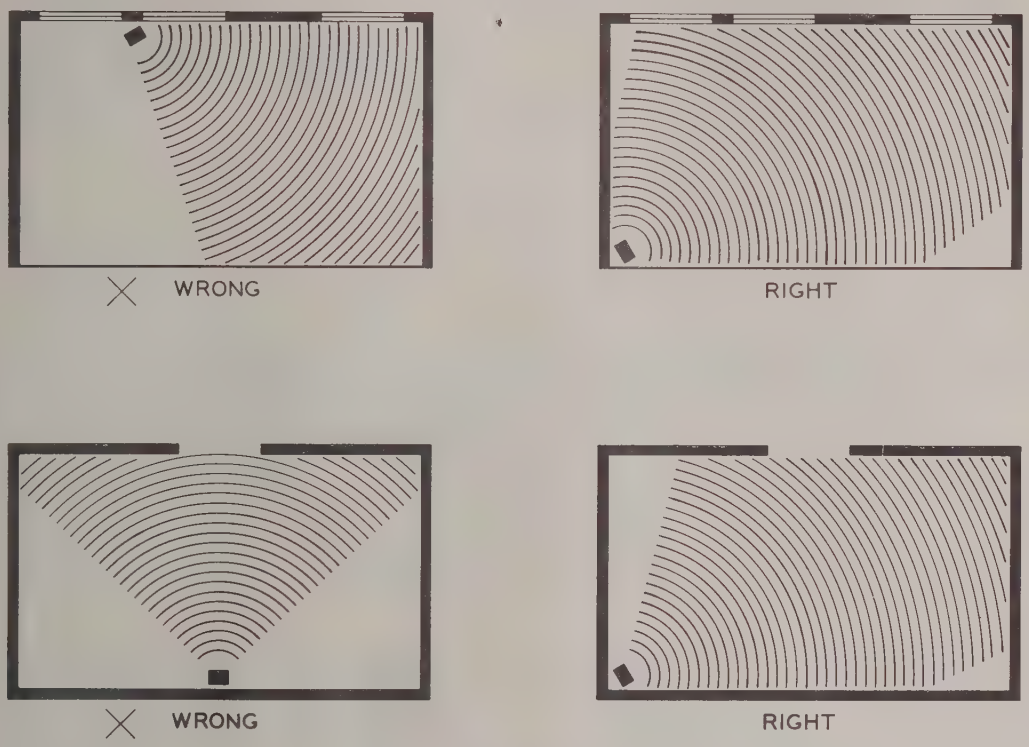


Figure 3-2

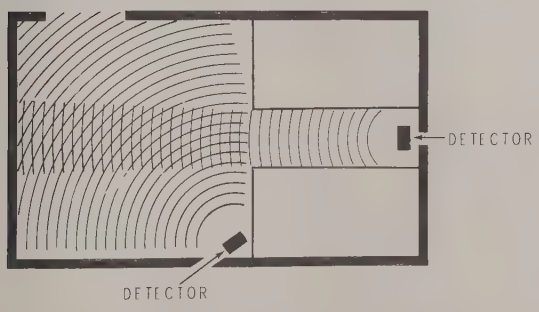
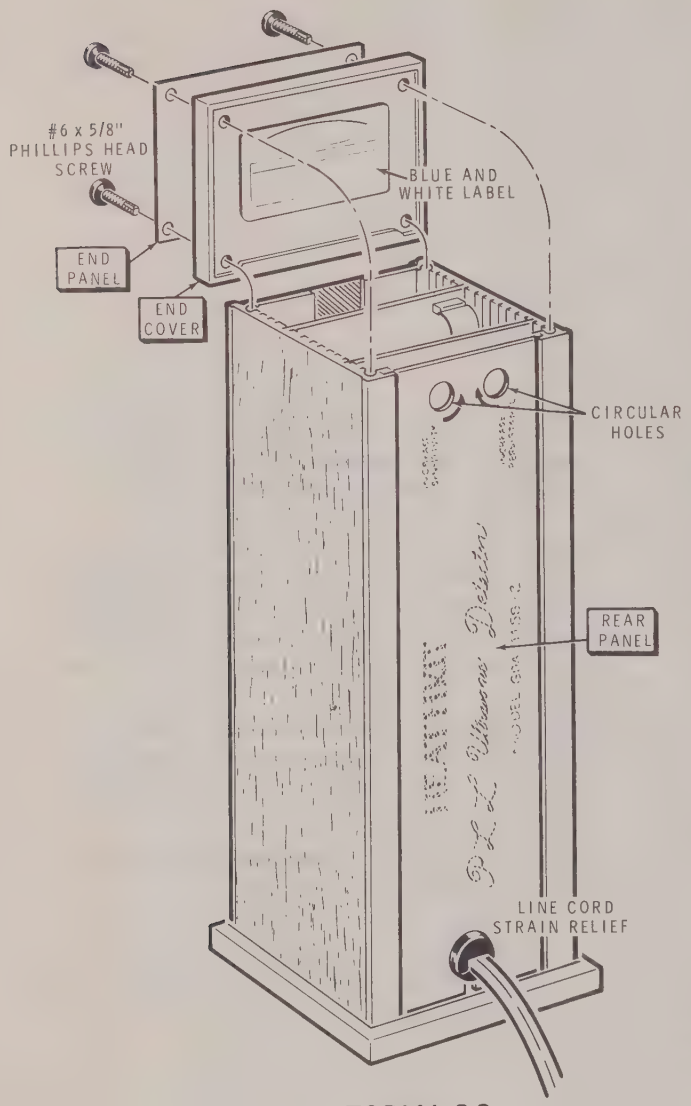


Figure 3-3

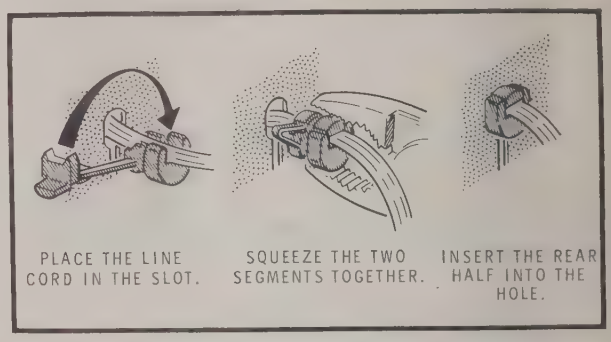


PICTORIAL 3-2

Refer to Pictorial 3-2 for the following steps.

( ) Position the rear panel upright so the two circular holes are up, and so the writing faces outward from the rear of the cabinet. Slide the rear panel downward into the slots on the rear flanges of the cabinet as shown.

( ) Slightly twist the line cord coming from the PLL circuit board so it slides upward into the slot in the lower edge of the rear panel. Push the rear panel to the bottom of its slots.



Detail 3-2A

( ) Refer to Detail 3-2A and place the line cord strain relief on the line cord as shown. Push the strain relief into its hole in the rear panel.

( ) Check both circuit boards and the rear panel and be sure they are flush with, or slightly below, the top of the cabinet.

NOTE: Study the underside of the end plate that you previously removed from the cabinet. It has been molded so that it will properly fit the cabinet only one way.

( ) Remove the paper backing from the blue and white label and press the label in place on the inside of the top end plate as shown in the Pictorial. NOTE: Refer to the numbers on this label in any communications you have with the Heath Company about this kit.

( ) Place the end cover, and then the end panel onto the top of the cabinet. Secure them to the cabinet with four 6-32 x 5/8" screws you previously removed.

This completes the assembly of your PLL Ultrasonic Detector.

INSTALLATION AND FINAL ADJUSTMENT

You can install the Ultrasonic Detector at any convenient location as long as you connect it to an AC outlet that is on the same secondary power line as the Central Processor. Most buildings are wired on only one secondary power line. (The secondary power line is the line that connects the building to the line transformer. See Figure 3-1.) If you wish to install the Ultrasonic Detector in one building, and the Central Processor in another building, try the system to make sure that they are both on the same secondary power line.

NOTE: If your neighbor's house is on the same secondary power line as your house, and if he also has an alarm transmitter, his transmitter can cause interference with your system. If this should happen, contact your Technical Correspondent at the Heath Company.

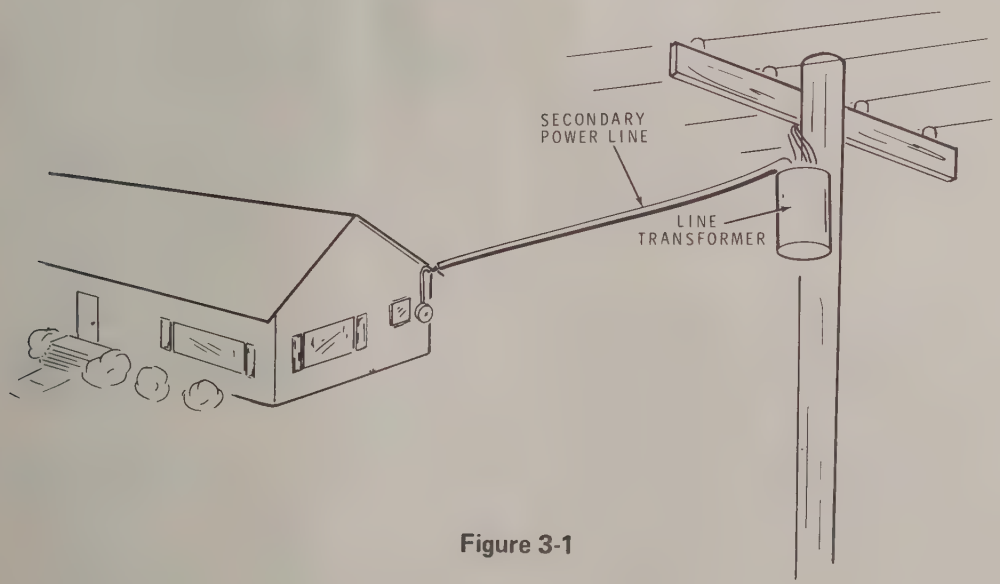


Figure 3-1

Refer to Figure 3-2 (fold-out from Page 26) as you read the following information.

Position the unit on a solid surface, preferably a load-bearing wall, to minimize the "False triggering" effects of shock and vibration. We suggest that you install it five to seven feet above the floor with the unit angling down 15 to 30 degrees from the horizontal.

( ) Make sure the Sensitivity control is set to the center of its rotation.

( ) Set the Persistence control fully counterclockwise.

( ) Set the Ultrasonic Detector as close as possible to its final location.

( ) Plug the Detector into an AC receptacle; wait 30 seconds.

( ) Walk across in front of the Detector to determine its range (the red light-emitting diode will light).

( ) If the unit does not react at the desired distance, turn the Sensitivity control clockwise approximately 1/8 turn. Again, check the distance at which the LED will light.

( ) Repeat the above procedure, alternately adjusting the Sensitivity control until the LED lights at the desired range.

NOTE: Do not use a higher Sensitivity setting than is required for proper coverage. The most desirable setting is that at which the Detector does not respond to movements directly adjacent to the walls of the room, but adequately covers the center portion.

( ) Set the Persistence control in one of the following two ways. Either turn the control until you obtain the desired length of time a motion must persist to activate the Detector, or turn the control to the center of its rotation.

Since the Ultrasonic Detector is a motion sensor, in some situations it cannot distinguish between the movement of people and the movement of other objects within its field of coverage. Walls, windows, doors, drapes, hanging signs, etc., may activate the Detector if they are in motion or are vibrating.

To achieve a trouble-free installation, carefully consider the following situations.

Is there considerable street traffic? What is the exact traffic pattern close to the building? Is the house or business situated near a main road or a railroad? Will large aircraft be flying overhead? Under conditions such as these, you should not install the Detector on an outside wall adjacent to the heavy flow of traffic. Trucks, aircraft, and railroads may cause wall vibration, which in turn can trigger the Ultrasonic unit.

In most cases, the Ultrasonic protection need not cover the entire home or business, only the critical areas such as entryways, stairs, halls, landings, or possibly just one room. In a business, these areas might be the stockroom, receiving area, storage area, etc. The importance of reflected sound waves in this type of equipment makes the type of surrounding surfaces important when you consider the total coverage of the unit. Smooth, hard surfaces such as concrete, wood, glass, vinyls, etc., are good reflectors, and tend to increase the size of the area covered. Draperies and carpets will have little effect on the range. For a particular installation, the Sensitivity control should be adjusted for enough range to adequately cover the area without being oversensitive. Glass windows, especially those that are large, such as picture windows or store-front plate glass windows, are subject to vibration from passing trucks or wind gusts. In such cases, position the Detector in such a way as to avoid reflecting the ultrasonic waves off the glass area. Avoid positioning the unit directly in front of such an area. A corner installation would be most desirable in this case.

Be careful with installations near heating or air conditioning ducts. Ultrasonic Detectors will detect ultrasonic sound waves that are reflected from the thermal barrier, or boundary layer, set up in moving air at temperatures above or below that of the surrounding area. Open fires, such as those in a fireplace, will almost always activate the Detector, particularly if it positioned on a wall or in a corner opposite the open hearth. If you need a Detector in an area where an open flame may be present, place the unit in a horizontal position with the front of the unit facing away from the flame.

Remember, too, that house pets may easily trigger an alarm. If the unit is "armed," be sure that animals are kept from the protected area.

TWO OR MORE ULTRASONIC DETECTORS

If your system requires two or more Ultrasonic Detectors in the same building, it is possible for the Detectors to "talk" to each other. That is, one Detector may receive the signals that are transmitted by the other Detector. Therefore, it is very important to place them far apart and in such a way that they will not interfere with each other. See Figure 3-3 (fold-out from Page 26).

IN CASE OF DIFFICULTY

Begin your search for any trouble that occurs after assembly by carefully following the steps listed below in the "Visual Tests." After the "Visual Tests" are completed, refer to the "Troubleshooting Chart," if necessary.

NOTE: Refer to the "Circuit Board X-Ray Views" on Page 37 for the physical location of parts on the circuit boards.

VISUAL TESTS

1. Check to be sure that all transistors and diodes are in their proper locations. Make sure each lead is connected to the proper point. Make sure that each diode band is positioned above the band printed on the circuit board. NOTE: Both circuit boards have all the diode bands in the same direction. Be sure to check especially for diode D206 (see Page 18).

2. About 90% of the kits that are returned to the Heath Company for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure they are soldered as described in the "Soldering" section of the "Kit Builders Guide." Be sure there are no solder bridges between circuit board foils.

3. Check the values of the parts. Be sure in each step that the proper part has been wired into the circuit, as shown in the Pictorial diagrams. It would be easy, for instance, to install a 22 kΩ (red-red-orange) resistor where a 3300 Ω (orange-orange-red) resistor should have been installed.

4. Check for bits of solder, wire ends, or other foreign matter which may be lodged on, or near, the circuit boards.

5. Look on the underside of each circuit board to be sure all leads have been cut off. Be sure that none of the wire ends touch each other.

6. A review of the "Circuit Description" may also help you determine where the trouble is.

If the trouble is still not located after the "Visual Tests" are completed, and a voltmeter is available, check voltage readings against those shown on the "Voltage Charts" on Page 38. Read the "Precautions for Troubleshooting" before you make any measurements. NOTE: All voltage readings were taken with a high impedance voltmeter. Voltages may vary ±20%.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover of the Manual.

PRECAUTIONS FOR TROUBLESHOOTING

1. Be cautious when you test diode or transistor circuits. Although they have almost unlimited life when used properly, they are sensitive to excessive voltage or current. Some ohmmeters can apply over 1.5 volts and currents which exceed 100 mA. Use ohm range settings of R x 10 or higher.

2. Be sure you do not short any terminals to ground when you make voltage measurements. If the probe should slip, for example, and short across components or voltage sources, it is very likely to cause damage to one or more transistors, diodes, or integrated circuits.

CAUTION: Do not make any voltage measurements with an AC line-connected voltmeter, unless you are certain the common (ground) lead is not grounded to the AC circuit. A voltmeter of this type may be used, however, if the PLL Ultrasonic Detector is first connected to the AC power source through an isolation transformer. Observe the same precautions when you use any test equipment on the Ultrasonic Detector.

TROUBLESHOOTING CHART

Before you attempt to repair the PLL Ultrasonic Detector, refer to the "Alignment" section of the Central Processor Manual to be sure those steps have been properly performed. Be sure the Detector is plugged into a "live" AC outlet. Make sure the Sensitivity Control is not turned fully clockwise.

If, after rechecking the adjustments, your Detector fails to perform satisfactorily, remove the end panel and cover near the Sensitivity and Persistence controls and check the interconnecting cable between the two circuit boards. Be sure both ends of the cable are seated firmly in their sockets.

To properly connect a voltmeter or VOM to the test points in the following chart, connect the meter common (ground) lead to the negative (–) lead of either C206 or C207. Then, to make the test, connect the positive meter lead to the point indicated.

CAUTION: Hazardous voltages will be present on some areas of the circuit boards. Refer to the "Voltage Chart" on Page 38. If voltage checks will be made with a line-connected voltmeter, be sure to connect the PLL Ultrasonic Detector to an AC source through an isolation transformer.

NOTE: Connect test equipment negative (common) leads to the negative (—) lead of capacitors C206 or C207.

SYMPTOM	TEST CONDITION	INDICATION SHOULD BE	POSSIBLE PROBLEM AREA
Walk Light (red LED) OK, but unit does not transmit to Central Processor.*	Connect VOM Positive Lead To:		
	Emitter of Q209	7 volts DC	1. Capacitors C219 or C220.
	Collector of Q207	9 volts DC, dropping to 0 volt.	2. Transistors Q206, Q207, Q208, or Q209.
	Base of Q206	11 volts DC, if activated, dropping to 0 volt.	3. Diodes D208 or D209.
	Collector of Q207	4 volts p-p at 56 kHz.	4. Coil L203.
Walk Light (red LED) will not turn ON.	Short between emitter and collector of Q205.	Light should turn ON.	1. Light emitting diode (LED) D103.
Unit may or may not transmit to Central Processor.	Short between emitter and collector of Q204.	Light should turn ON.	2. Transistor Q205.
	Short between emitter and collector of Q203.	Light should turn ON.	3. Resistor R215, Capacitor C214, or transistor Q204.
	Short between emitter and collector of Q202.	Light should turn ON.	4. Transistor Q203.
Walk Light (red LED) will not turn On. Unit will not transmit to Central Processor.	Connect VOM or oscilloscope to Pin 6 of A101.	2 to 4 volts peak-to-peak at approximately 35 kHz.	1. Transistors Q101 or Q102, Coil L101, or IC A101.
	Connect VOM or oscilloscope to Pin 6 of A102.	Observe 2 to 6 volts peak-to-peak AC at approximately 90 Hz, while waving hand in front of receiver transducer. Note about 7.5V DC at this point.	2. IC A102.
	Connect oscilloscope to Pin 6 of A201.	Observe 1 to 3 volts peak-to-peak at 90 Hz — negative half of waveform only (7.5V DC).	3. IC A201.
Unit has short range. 2 to 10 feet.	Short between base and emitter of Q103.	Range should decrease substantially.	1. Transistors Q103 or Q104. 2. Coil L102. 3. Diode D104.

*To test transmitter: Connect a jumper wire between TP7 and TP22; this enables the transmitter.

SPECIFICATIONS

Ultrasonic Circuits:	
Operating Frequency	Approximately 35 kHz.
Motion Persistence	Discernable minimum, 1/2 second.
Sensitivity (range)	More than 20 feet.
Initial Turn-on Delay	Approximately 20 seconds.
PLL Circuits:	
Transmitter Frequency	56 kHz.
Modulation (FM)	13 Hz square wave.
Maximum Burst Length	10 seconds.
Power Requirement	1 watt, 110-130 VAC, 60 Hz.
Dimensions (overall)	10-5/8" high x 3-1/4" wide x 3-1/4" deep (27 cm. x 8.26 cm. x 8.26 cm.).
Net Weight	2 lb. (0.746 kg.).

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram (fold-out from Page 41) as you read the following information.

RECEIVER

Transistors Q101 and Q102, with integrated circuit (IC) A101 make up the receiving section which serves two purposes. First, it amplifies the signal, and second, it forms an oscillator which generates a frequency determined by the receiving transducer. Transistor Q101 is the oscillator transistor and IC A101 provides gain to drive diodes D101 and D102. The DC voltage level developed is dependent on the signal level. This controls the effective resistance of transistor Q102 and thus maintains the oscillator level of Q101. The oscillator frequency is approximately 35 kHz. When reflected sound waves are picked up by the receiver, a modulation of the oscillator results. This modulation is detected by diodes D101 and D102.

The signal from diodes D101 and D102 is also routed through IC A102, which is an operational amplifier and is responsive to a particular band of frequencies because the feedback circuit of A102 has a twin-T filter. The band of frequencies passed by IC A102 determines whether the unit responds to moving air, moving people, high speed motors, and many other types of signals, most of which must be filtered and rejected. Therefore, the amplifier is designed to pass frequencies in the range of 80 to 100 Hz. This stage is referred to as a "Selective amplifier."

TRANSMITTER

Transistors Q103 and Q104 amplify the 35 kHz signal to drive the transmitter transducer at approximately 40 volts peak-to-peak. The extra driving voltage is generated by coil L102 and diode D104 as transistor Q104 switches on and off. This produces the ultrasonic sound with which the unit operates. Transistors Q105 and Q106 form a voltage regulator to keep supply voltage variations from affecting the oscillator and receiver circuits, and provides the 20-second turn-on delay.

INTEGRATOR

Integrated circuit A201, diodes D206 and D207, and transistor Q202 form the circuit of a motion detector to perform the function of turning the motion signal (80 to 100 Hz) into a DC signal, but only after the signal has persisted for at least one-half second. How long the signal must last is determined by integrator transistor Q203 and the charging time-constant of R214, R215, and C214. When C214 is charged enough, transistors Q204 and Q205 are turned on. This, in turn, activates the PLL transmitter – once for each motion signal – by charging capacitor C215. While C215 charges, the transmitter is turned on for several seconds. When C215 is fully charged, the transmitter cuts off. Transistor Q205 is cut off when there is no detectable movement. This discharges capacitor C215 through resistor R222, LED D103, diode D215, and resistor R220. Further movement will enable transistor Q205 to recharge C215.

PLL TRANSMITTER

Transistors Q206 and Q207 form an oscillator, the frequency of which is determined by coil L203 and capacitor C220. This frequency is approximately 56 kHz and is modulated by IC A202 and transistor Q211, which switches capacitor C223 across coil L203 at the rate of approximately 13 Hz. The FM signal is amplified by transistors Q208, Q209, and Q210, and is coupled to the power line through capacitor C225, and capacitor C205 provides a return path. Resistor R203 prevents a short circuit for the 56 kHz signal.

POWER SUPPLY

The line voltage is changed from 115 volts AC to low voltage DC by limiting capacitors C202, C203, C204, C224, and bridge rectifier D201 through D204. The low voltage DC is regulated by reference zener diode D205 and shunt regulator transistor Q201. Capacitor C201 and resistor R202 prevent static charge buildup on the cabinet.

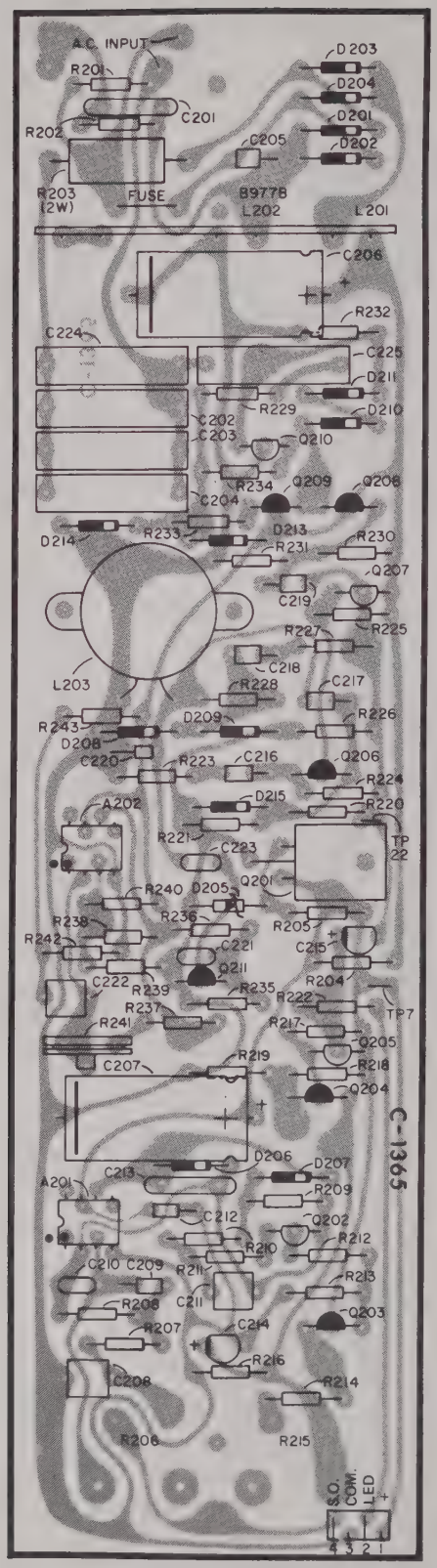
CIRCUIT BOARD X-RAY VIEWS

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

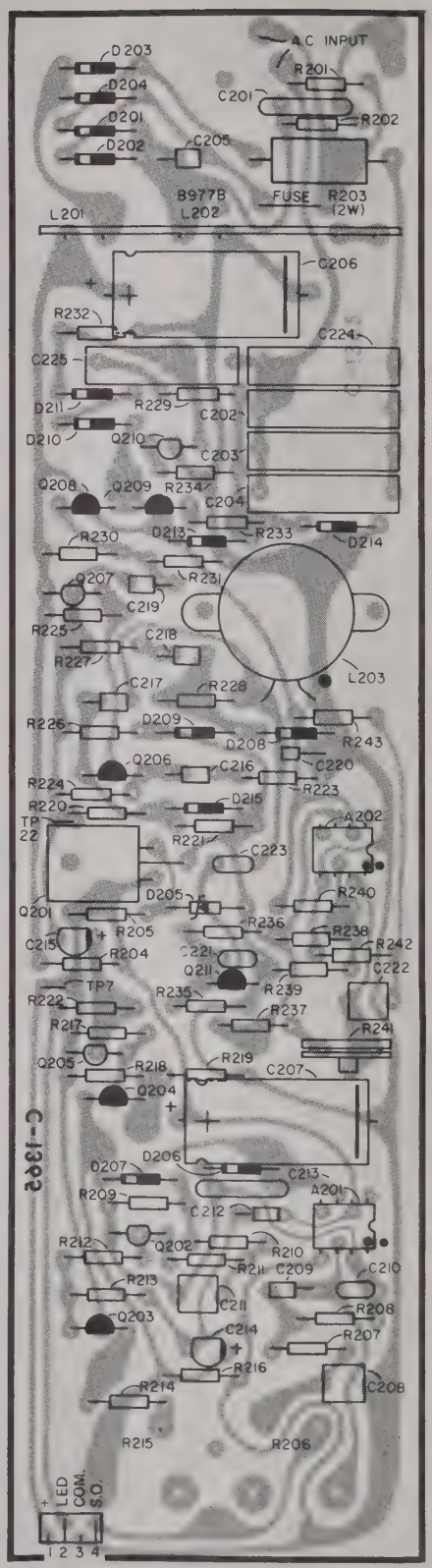
A. Find the circuit component number (R105, C103, etc.) on the X-Ray View.

B. Locate this same number in the "Circuit Component Number" column of the "Parts List" in the front of this Manual.

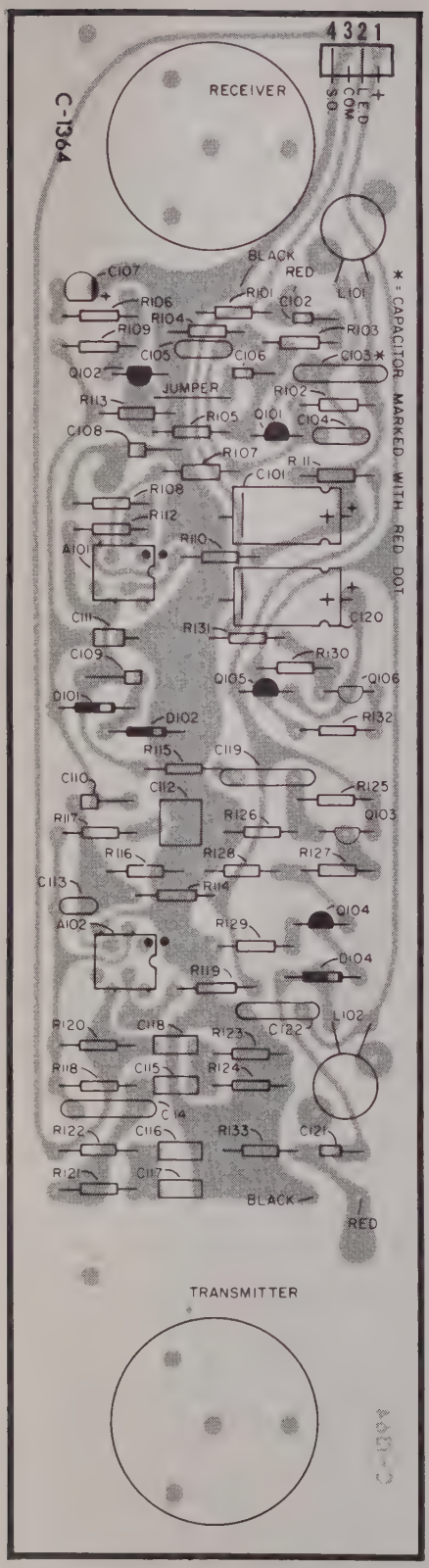
C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



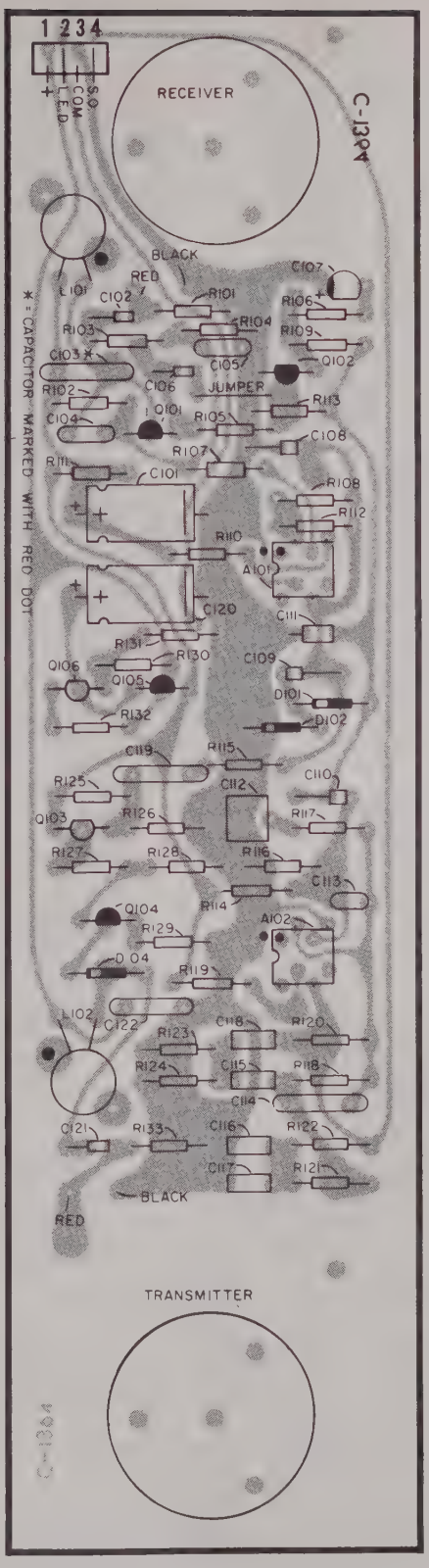
PLL CIRCUIT BOARD
(Viewed from component side)



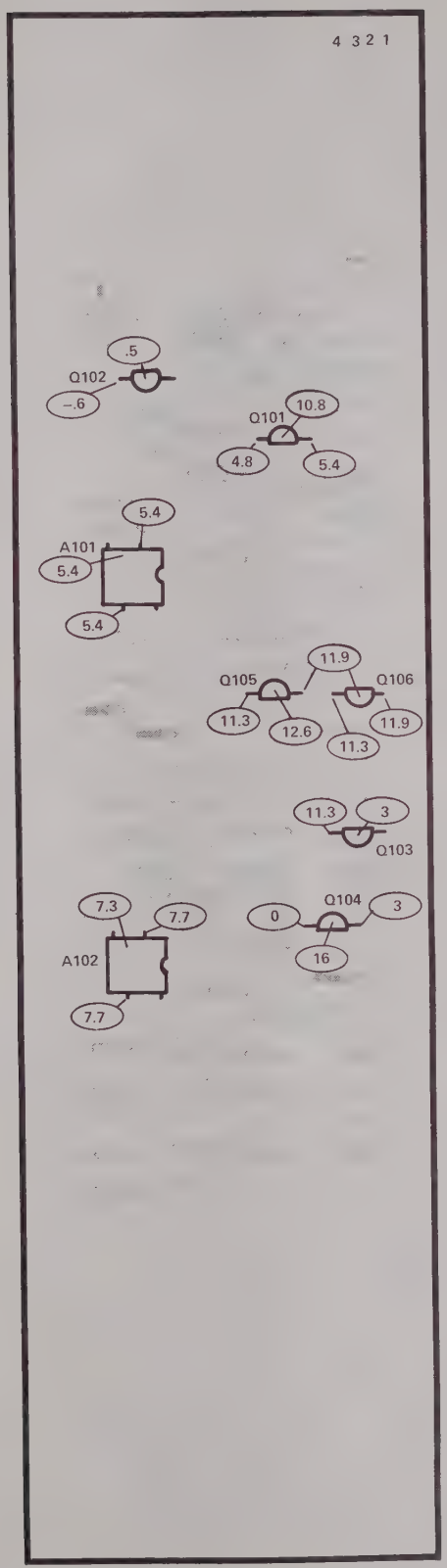
PLL CIRCUIT BOARD
(Viewed from foil side)



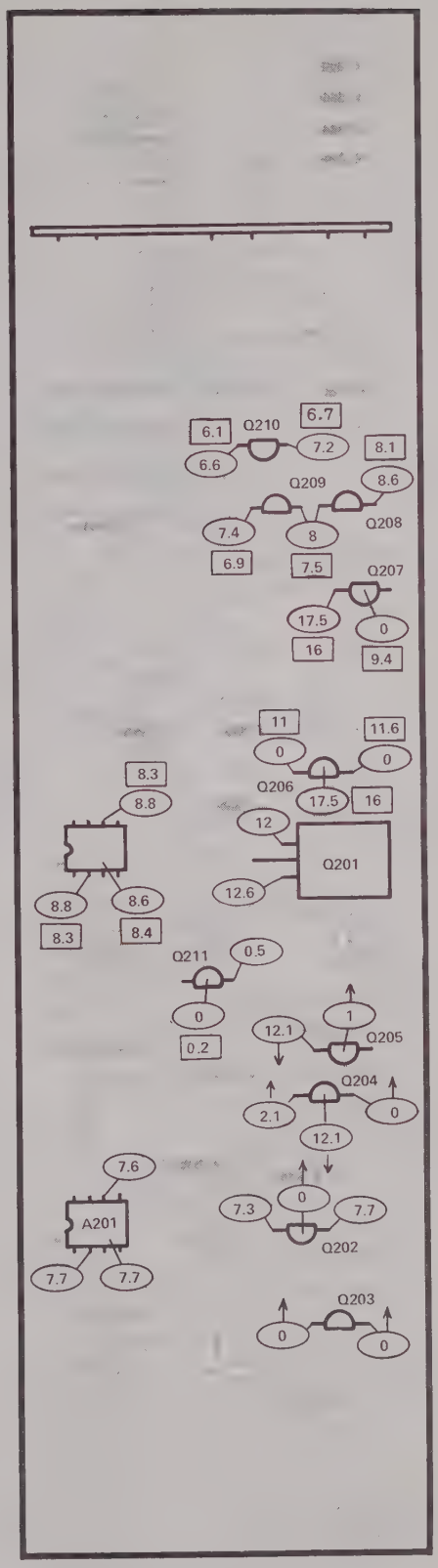
ULTRASONIC CIRCUIT BOARD
(Viewed from component side)



ULTRASONIC CIRCUIT BOARD
(Viewed from foil side)



ULTRASONIC CIRCUIT BOARD
(Viewed from component side)



PLL CIRCUIT BOARD
(Viewed from component side)

CIRCUIT BOARD VOLTAGE CHARTS

NOTES:

1. Voltages taken from the point indicated to ground or common at the negative (–) leads of capacitors C206 or C207 with a high impedance input volt-ohmmeter.
2. Voltage readings may vary ±20%.
3. Test conditions: Power on, through an isolation transformer; adjusted to 120 VAC, 60 Hz.
4. Symbols:

= DC voltage (unit not transmitting to Central Processor).

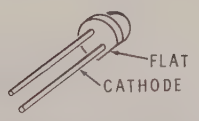
= DC voltage (unit transmitting to Central Processor).

= DC voltage that varies downward as motion is detected.

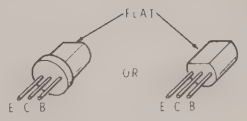
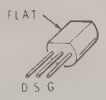
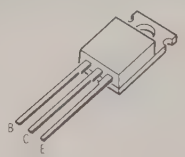
= DC voltage that varies upward as motion is detected.

DIODE-TRANSISTOR-IC IDENTIFICATION CHARTS

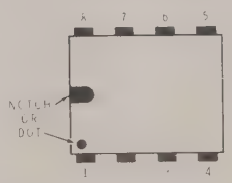
DIODES

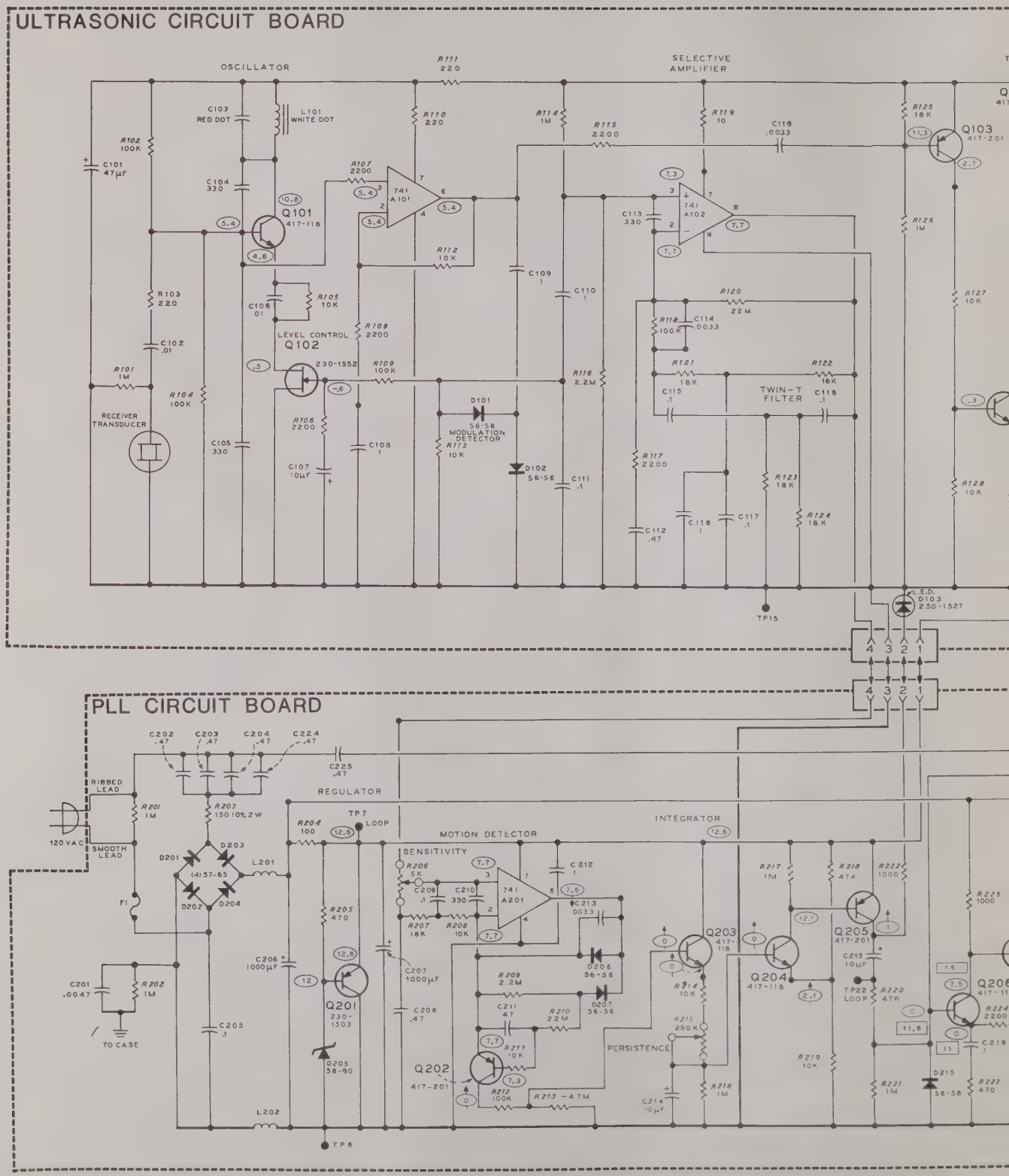
COMPONENT	PART NO.	MAY BE REPLACED WITH	CASE DIAGRAM
D101, D102, D104, D206, D207, D208, D209, D210, D211, D215	56-56	1N4454 or 1N4149	
D205	56-90	1N4742A or 1N5738B or ZB12A	
D103	230-1527	FLV-117	
D201, D202, D203, D204, D213, D214	57-65	1N4002 OR SCE1	

TRANSISTORS

COMPONENT	PART NO.	MAY BE REPLACED WITH	CASE DIAGRAM
Q101, Q104, Q105, Q203, Q204, Q206, Q208, Q209, Q211	417-118	2N3393 or GE4936	
Q103, Q106, Q202, Q205, Q207, Q210	417-201	X29A829 or GE1691	
Q102	230-1552	MSPF755	
Q201	230-1503	64566 or 2N6106	

INTEGRATED CIRCUITS

COMPONENT	PART NO.	MAY BE REPLACED WITH	CASE DIAGRAM
A101, A102, A201, A202	442-22	#741 or A-1060	


ULTRASONIC CIRCUIT BOARD
OSCILLATOR
SELECTIVE AMPLIFIER
R111 220
C103 RED DOT
L101 WHITE DOT
R102 100K
C101 47µF
C104 330
Q101 417-118
R107 2200
741 A101
R110 220
R112 10K
R114 1M
R115 2200
R119 10
C119 .0033
741 A102
C113 330
R125 18K
Q103 417-201
R126 1M
R127 10K
R128 10K
C109 1
C110 1
R120 22M
R118 100K
C114 .0033
R121 18K
R122 18K
C115 .1
C116 .1
TWIN-T FILTER
R103 220
C102 .01
R101 1M
R104 100K
RECEIVER TRANSDUCER
C105 330
R105 10K
C106 01
LEVEL CONTROL Q102
230-1552
R108 2200
R109 100K
C107 10µF
C108 1
D101 56-56 MODULATION DETECTOR
R113 10K
D102 56-56
C111 .1
R116 2.2M
R117 2200
C112 .47
C116 1
C117 .1
R123 18K
R124 18K
L.E.D. D103 250-1527
TP15
4 3 2 1
4 3 2 1
PLL CIRCUIT BOARD
C202 .47
C203 .47
C204 .47
C224 .47
C225 .47
RIBBED LEAD
SMOOTH LEAD
120 VAC
R201 1M
R203 150 10% 2W
REGULATOR
TP7 LOOP
R204 100
MOTION DETECTOR
INTEGRATOR
SENSITIVITY
D201
D202
(4) 57-65
D203
D204
L201
F1
R206 5K
C209 .1
C210 330
741 A201
C212 1
C213 0033
R207 18K
R208 10K
R205 470
C206 1000µF
C207 1000µF
C208 .47
Q201 230-1503
C201 .0047
R202 1M
TO CASE
C205 1
D205 56-90
L202
TP6
R209 2.2M
C211 47
R210 22M
D206 56-56
D207 56-56
R211 10K
Q202 417-201
R212 100K
R213 4.7M
R214 10K
R215 250K
PERSISTENCE
C214 10µF
R216 1M
Q203 417-118
Q204 417-118
R217 1M
R218 47K
R222 1000
Q205 417-201
C215 10µF
TP22 LOOP
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R219 10K
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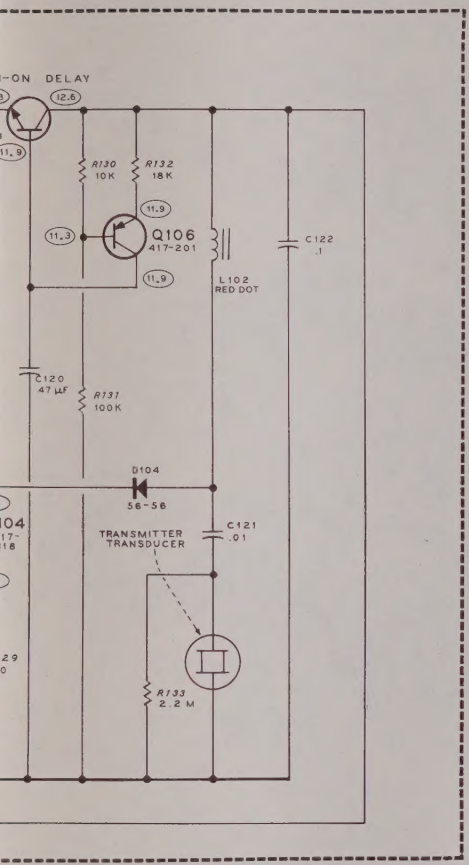
D215 56-56
R223 470
R225 1000
Q206 417-11
R224 2200
C216 .1



SCHEMATIC OF THE HEATHKIT® PLL ULTRASONIC DETECTOR MODEL GDA-1158-2

NOTES:

1. COMPONENT NUMBERS ARE IN THE FOLLOWING GROUPS:

   100-199 PARTS ON THE ULTRASONIC CIRCUIT BOARD.

   200-299 PARTS ON THE PLL CIRCUIT BOARD.

2. ALL RESISTORS ARE 1/4-WATT, UNLESS OTHERWISE NOTED. RESISTOR VALUES ARE IN OHMS (K=1000, M=1,000,000).

3. CAPACITORS LESS THAN 1 ARE IN µF (MICROFARADS). ALL OTHER CAPACITORS ARE IN PF (PICOFARADS) UNLESS OTHERWISE MARKED.

4. THE FOLLOWING SYMBOLS INDICATE A DC VOLTAGE MEASURED WITH A HIGH IMPEDANCE INPUT VOLTMETER FROM THE POINT INDICATED TO THE COMMON BUS (NEGATIVE LEAD OF C206 & C207).

   ⬭ = NOT TRANSMITTING

   ▭ = TRANSMITTING

   A DC VOLTAGE THAT WILL INCREASE WITH MOTION DETECTION.

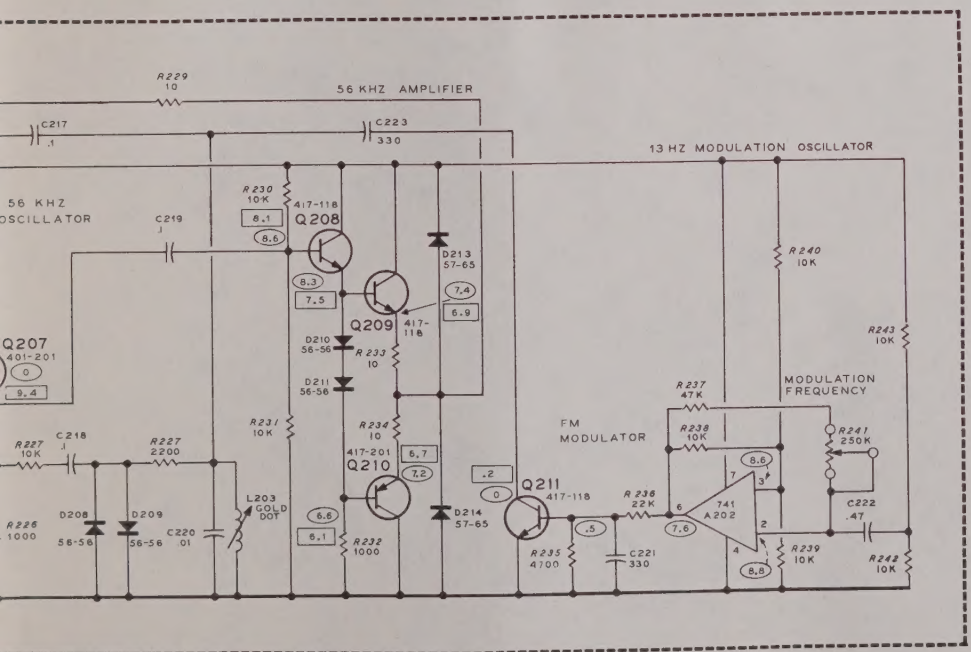
   A DC VOLTAGE THAT WILL DECREASE WITH MOTION DETECTION.

5. ⏚ THIS SYMBOL INDICATES CIRCUIT BOARD GROUND.

6. ⟩— THIS SYMBOL INDICATES A CIRCUIT BOARD FEMALE CONNECTOR.

7. REFER TO THE "X-RAY VIEWS" FOR THE PHYSICAL LOCATION OF PARTS.

8. TP LOOP = LOOP OF WIRE ON COMPONENT SIDE OF BOARD.



FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

INSTRUCTIONS

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, $3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.

  Total enclosed $_____
- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # _____ Invoice # _____

Date Purchased _____ Location Purchased _____

LIST **HEATH** PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE
TOTAL FOR PARTS			
HANDLING AND SHIPPING			
MICHIGAN RESIDENTS ADD 4% TAX			
TOTAL AMOUNT OF ORDER			

SEND TO: **HEATH COMPANY**
BENTON HARBOR
MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

CUT ALONG DOTTED LINE

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

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MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

HEATH

Schlumberger

MP MASTER

MA22816

HEATH COMPANY • BENTON HARBOR, MICHIGAN

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

LITHO IN U.S.A.